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Active Buying of Pig Iron in East

Subway Casting Contracts Call for Heavy Tonnages—Heavy Demand for Shells—November Steel Lettings Large

THE sellers of pig iron and finished products are trying to check buying for future delivery and are succeeding to some extent, but the demand continues very strong and prices are firm.

Bars

The policy of the warring nations seems to indicate an increasing disposition to place order for blooms, billets and forgings for the manufacture of high explosive shells and the demand for this material is, to some extent, taking the place of that for shrapnel rounds. The belligerents are willing to accept shipments throughout the year, although until recently they would not purchase for delivery after July 1. The mills are very conservative about contracting for delivery during the last half, and makers of steel bars are not taking orders very freely at the present time. They could probably obtain as high as 2.50c, Pittsburgh, for prompt delivery.

Pig Iron

Melters of pig iron are showing greatly increased interest in the market for the last half of next year and are endeavoring to contract for delivery during that period. There is no uniformity of policy, but most furnaces are either refusing to quote at all for last half or are quoting at an advance of $1 over present prices. Some furnaces are, however, willing to quote the same prices for the last half as now prevail for the first half. Southern prices are strong and while there is still some iron obtainable at $14 for No. 2 foundry, Birmingham, for first half, most sellers are quoting $14.50 and one has advanced to $15. The statistical situation in eastern Pennsylvania is very strong, where orders on hand amount to about 500,000 tons, while stocks are only about one-eighth that tonnage. Along the lakes, $18 seems to be the minimum quotation on malleable, basic and No. 2 foundry, and there is a scarcity of foundry grades. A number of sales for extended delivery have been made in the east, including 15,000 to 20,000 tons of standard forge to a Troy, N. Y., consumer by a Buffalo furnace and 5,000 to 10,000 tons of forge iron additional from a New York state furnace, making the total recent purchases of the Troy concern about 30,000 tons of forge, some being for delivery into the third quarter of next year. The price was about $18, delivered. Two Lehigh valley furnaces will furnish about 25,000 tons of foundry and forge pig iron for the casting of New York tunnel segments by a Catasauqua, Pa., foundry, while a Buffalo concern will furnish 12,000 tons for the segments to be made by a Buffalo concern and nearby furnaces will furnish the iron needed for the segments to be made by a Wheeling company.

Shapes

Structural contracts for November, according to the statistics of the Bridge Builders' and Structural Society, amounted to 180,000 tons, the largest tonnage for one month in several years, but new projects are not developing rapidly and many of the smaller shops in the central west are in need of business. Plates continue to be very strong and one prominent eastern company has practically withdrawn from the market on account of its filled-up condition. It is true, however, in the case of plates, as it is in shapes, that many of the smaller consumers are not busy and in some cases where unspecified tonnages have been cancelled by the mills the buyers have readily consented.

Machinery

The proclamation issued by the British government prohibiting the importation into the United Kingdom of all machine tools except under certain conditions, has aroused much interest among machine tool manufacturers. It is evident, however, that the government will permit all the importations that it needs for its own use or for the making of munitions by private concerns, but the buying will be under government control and it is expected that in this way some of the unsatisfactory conditions of the past will be eliminated. The demand for lathes and other tools continues very heavy from Russia. There is also active buying by industrial concerns, especially ship building companies.

THE OPEN HEARTH

Building a Merchant Marine

IN READING addresses and reports of discussions in regard to the future trade relations of this country with foreign nations, one is deeply impressed by the fact that uppermost in the mind of nearly everyone who takes part in the consideration of this subject is the importance of establishing a merchant marine. For example, at the international trade conference held in New York last week, this subject was a prominent feature of the discussions. Among those who spoke on it were John Bassett Moore, Bernard N. Baker and Emery R. Johnson, professor of transportation and commerce at the University of Pennsylvania.

Professor Moore, perhaps on account of his training as a diplomat, speaks very cautiously in regard to government ownership of vessels. He quotes from a speech of the secretary of the treasury, who said, "We can prove the falsity of the claim that ships canot be operated under the American flag at a profit." Then the professor naively remarks, "On this demonstration the permanency of any policy in regard to the merchant marine would no doubt largely depend." Certainly, it would, and the trouble is that such a demonstration would require a long time.

Professor Johnson advocates the establishment of a shipping board which, to some extent, would be to shipping what the interstate commerce commission is to railroads, but it should not have the power to engage in the steamship business, either directly or indirectly. It would be a body of experts and among other things would investigate the shipping and navigation laws of the United States and report at an early date a revised code of maritime laws. The general functions at the beginning would be primarily to aid and supervise rather than to regulate.

Mr. Baker also advocated a shipping board, but he would give it much greater powers than those suggested by Professor Johnson. He would have the board investigate discriminations in ocean rates of freight and give it power to regulate them. He also favors an appropriation of $60,000,000 for the development of the merchant marine, the board to have the power to invest this amount in building, acquiring, leasing or operating all ships and to establish lines of steamers to foreign ports, giving necessary assistance to the operating companies. Perhaps the most interesting feature of Mr. Baker's speech was the reading of a letter from Secretary McAdoo, in which he said he was not wedded to any view. While he had strongly advocated government ownership of vessels, the secretary was willing to be convinced that some other plan would be better. "If," he said, "someone else can present a solution that is more practical and will be more efficacious, I shall be as quick to support it as I have been earnest in urging the views I have already presented." This expression of the secretary of the treasury is the first indication we have seen of a possibility of getting him to agree to any plan except his pet hobby of government ownership of ships. If all who are deeply interested in the upbuilding of the merchant marine will discuss it in the spirit of openmindedness and with a determination to agree upon some practical plan, it will be possible to find such a plan during the present session of congress.

An Unselfish Life

JAMES MAPES DODGE, whose life was ended at the time of its greatest usefulness, was an unusual type of the busy man of affairs who is not so engrossed in his own private matters that he cannot remember those about him. For many years, Mr. Dodge was noted for his thoughtfulness for all his employes and they had for him an affectionate regard, which is unusual in these days, when relations of employers and employes are not as close as they were years ago. Mr. Dodge adopted progressive methods and it was perfectly natural for him to work in harmony with Frederick Winslow Taylor, but there never was any suspicion of slave-driving or of any kind of methods to which the employes should object.

In the last few years of his life, Mr. Dodge had given up active business, to a large extent, and devoted his time to scientific, industrial and civic matters. While he never held public office, he was of the kind that would grace any office, and his influence and advice were freely given for the promotion of many causes. The city of Philadelphia mourns him as one of its best citizens. As president of the American Society of Mechanical Engineers and as an official of the Franklin Institute of Philadelphia, he rendered services of a very high order. He had a wide circle of friends and admirers throughout the country, on account of his intense interest in everything which was for the betterment of mankind and because of his never failing kindliness of disposition toward everyone with whom he came in contact.

John Sharp Williams, cotton planter and senator from Mississippi, has some sense of fairness about him, even if he is a free trader. Speaking of the proposed tax on pig iron and steel, he said, "You can't blame the steel manufacturers for objecting. I know I would kick if it were proposed to tax cotton." Of course, he would, and yet, what better right would he have to object than the iron and steel

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manufacturers have? Cotton is exported and is used by the warring nations. So are iron and steel. Hence, if one product is taxed, why not the other? The proposed tax on iron and steel will be vigorously opposed. Its advocates will do well to drop it.

How to Get the Facts

THE paragraph of the President's message, which doubtless was written with the tariff in mind, is remarkable for its vagueness. It is as follows:

"Many conditions about which we have repeatedly legislated are being altered from decade to decade, it is evident, under our very eyes, and are likely to change even more rapidly and more radically in the days immediately ahead of us, when peace has returned to the world and the nations of Europe once more take up their tasks of commerce and industry with the energy of those who must bestir themselves to build anew. Just what these changes will be no one can certainly foresee or confidently predict. There are no calculable, because no stable, elements in the problem. The most we can do is to make certain that we have the necessary instrumentalities of information constantly at our service, so that we may be sure that we know exactly what we are dealing with when we come to act, if it should be necessary to act at all. We must first certainly know what it is that we are seeking to adapt ourselves to. I may ask the privilege of addressing you more at length on this important matter a little later in your session."

Evidence that the President really had the tariff in mind when he wrote the above paragraph is furnished by the report that in an address to the members of the national committee of his party he spoke more plainly and declared that nobody knows today what ought to be done in regard to tariff schedules. This is true, and it is also true that everything that can be done should be done to obtain information upon which to base new tariff schedules. Possibly the President is still of the opinion that the necessary investigations could be carried on by the federal trade commission, but it seems to us that the only satisfactory method of thoroughly investigating conditions connected with the imports from foreign countries is to establish a non-partisan tariff commission. Such a commission could be organized at an early date and do a vast amount of work before the war ends. And then, if a truce should be declared, followed by a long period of negotiation, an opportunity for still further determination of facts will be presented, so that by the time of the final signing of the treaty of peace the necessary revision of the tariff schedules could be enacted into law by congress. This work of investigation never could be done satisfactorily by a commission which is already overburdened by its many duties.

Advertising That Pays

PECULIARLY apt comment on failure to advertise adequately by makers of steel for various purposes is presented in an editorial in the November number of *The American Roofer*, published at Chicago.

The comment follows closely the idea presented at the autumn meeting of the American Iron and Steel Institute at Cleveland, when George H. Jones, vice president of the Inland Steel Co., argued for manufacturers of steel products to advertise generaly to present the merits of their goods in competition with other materials used for the same purpose, and R. H. Sweetser, of the Thomas Iron Co., told of actual results of advertising pig iron.

The editorial referred to strikes a ringing note and shows how consumption of steel products for roofing might be increased by judicious general advertising, as follows:

From a business standpoint, the main question is advertising. In the roofing trades, conditions are peculiar, as some roofing materials are widely advertised, while others are not, and the demonstration is complete. The advertised roofings are fast coming to the front, while the non-advertised are falling behind. The evidence is too plain for argument. The prepared roofings are crowding out other materials because they are extensively advertised.

It is amusing to watch the antics of the shingle men, for example, under pressure of competition of other roofing materials. They hold conventions and adopt resolutions to the effect that shingle roofs are good roofs, and someone among them has the courage to suggest that they appropriate a lump sum for advertising. An effort is made to do this and possibly a small amount of money is raised and part of it is paid to lumber trade publishers for ads to lumber dealers. Meantime the prepared roofing manufacturers are spending ten-fold as much in a skillfully planned publicity campaign. We wonder if ever they will wake up to the fact that advertising is a serious matter and that it cannot be done successfully on a shoestring.

Similarly, the metal roofing interests are at fault in not heralding far and wide the merits of their products. Some of the leaders in this line are pointing out the mistaken policy of economy adopted by manufacturers of sheet metal—a policy that is permitting other roofing materials to get the business. And the fact is that the percentage of cost to manufacturers of sheet metal goods would be less than 1 per cent on their total sales, to cover an advertising campaign in this country amounting to millions of dollars annually.

Prices Present and Past

Quotation on leading products December 15, average for November, 1915, average for September, 1915, and average for December, 1914. Prices are those ruling in the largest percentage of sales at the dates named.

	Prices Dec. 15, 1915.	Aver. for Nov., 1915.	Average for Sept., 1915.	Aver. for Dec., 1914.
Bessemer pig iron, Pittsburgh..	$19.95	$17.45	$16.80	$14.70
Basic pig iron, Pittsburgh.....	18.95	16.70	15.65	13.45
No. 2 Fdy. pig iron, Pittsburgh	18.95	16.45	15.45	13.70
Northern No. 2 Fdy., Chgo....	18.00	17.12	13.80	13.00
Lake Superior Charcoal, Chgo..	19.25	17.50	15.95	15.75
Mall., Bess., Chgo.....	18.00	17.42	14.20	13.00
Southern No. 2, Birmingham...	14.00	13.50	11.50	9.50
Southern Ohio No. 2, Ironton..	17.50	16.25	14.50	12.63
Basic, eastern Pa.....	18.00	17.75	15.25	13.50
No. 2X Virginia furnace.....	16.75	15.50	12.75	12.50
No. 2X foundry, Philadelphia...	19.25	17.75	15.00	14.25
Ferro mang., Balti., (prompt)..	100.00	100.00	110.00	68.00
Bessemer billets, Pbgh.....	30.00	27.75	24.60	19.00
Bess. sheet bars, Pbgh.....	31.00	28.25	24.60	19.50
Op.-h'th sh. bars, Pbgh.....	31.00	28.50	25.80	19.50
Open-hearth billets, Pbgh.....	30.00	28.00	25.60	19.00
Steel bars, Chgo.....	1.99	1.79	1.54	1.20
Steel bars, Pittsburgh.....	1.80	1.625	1.34	1.10
Iron bars, Philadelphia.....	1.959	1.759	1.459	1.15
Iron bars, Cleveland, local del'y.	1.80	1.50	1.35	1.15

	Prices Dec. 15, 1915.	Aver. for Nov., 1915.	Average for Sept., 1915.	Aver. for Dec., 1914.
Iron bars, Chgo. mill.....	$1.75	$1.48	$1.31	$0.95
Beams, Chgo.	1.99	1.79	1.54	1.20
Beams, Pittsburgh	1.80	1.625	1.34	1.10
Beams, Philadelphia	2.009	1.759	1.509	1.20
Tank plates, Pittsburgh.....	1.80	1.625	1.32	1.07
Tank plates, Chicago.....	1.99	1.79	1.49	1.20
Tank plates, Philadelphia.....	2.009	1.759	1.509	1.20
Sheets, blk., No. 28, Pbgh.....	2.50	2.22	1.92	1.85
Sheets, blue an., No. 10, Pbgh.	2.25	1.85	1.52	1.35
Sh., galv., No. 28, Pbgh.....	4.75	3.906	3.67	2.85
Wire nails, Pittsburgh.....	2.00	1.87	1.69	1.55
Connellsville fur. coke, contr...	2.35	2.35	1.84	1.69
Connellsville fdy. coke, contr...	3.00	2.96	2.37	2.25
Heavy melting steel, Pbgh.....	18.50	15.31	14.25	10.30
Heavy melting steel, east'n Pa..	16.00	14.50	14.50	9.50
Heavy melting steel, Chgo.....	15.50	13.13	12.00	8.25
No. 1 wrought eastern Pa.....	20.50	17.00	16.00	11.50
No. 1 wrought, Chgo.....	15.50	12.75	10.75	7.50
Rerolling rails, Chgo.....	17.00	14.31	13.15	9.50
Car wheels, Chgo.....	14.75	12.73	11.75	10.00

(For Additional Prices See Page 1208.)

Inquiry for Pig Iron for Last Half

Buyers Would Like to Place Orders for Delivery After July 1—Policies of Furnaces Vary—Many Will Not Quote

Philadelphia, Dec. 13. — Inquiries for iron for last half shipment now are beginning to come out quite freely and many consumers appear bent upon covering themselves as far ahead as the furnaces will consent. There is a mixed attitude on the part of the producers in quoting upon these anticipated requirements. Some makers are willing to quote upon the same basis as first half until the outlook for consumptive conditions in the last six months is better defined; others want advances; while still others are declining to name prices at this time. Among the last half inquiries are about 10,000 tons for the Norfolk & Western railroad, including 3,000 tons of bessemer, 5,300 tons of Nos. 1, 2 and 3 foundry, 1,000 tons of special and 500 tons of charcoal. A local stove maker is in the market for last half. This buyer also has taken several thousand tons additional for first half, including 1,000 tons of No. 2X at $20, eastern Pennsylvania furnace. Other sales of eastern Pennsylvania at $20, furnace, for forward shipment have been closed including 1,000 tons to New England. Several eastern Pennsylvania makers now hold first half foundry at $19, furnace, for No. 2X or about $19.60 to $19.80, Philadelphia, and a number of smaller orders have been booked on this basis. It is reported these same prices can be obtained for second half. Several thousand tons of Virginia iron for second quarter have been sold in this district at $17, furnace, or $19.75, Philadelphia, for No. 2X, and the leading Virginia maker will accept this same figure throughout the year. Other Virginia producers have advanced to $17 furnace for No. 2X, first half, and one special brand is held at $18. A Trenton consumer was a buyer of 1,000 tons of northern foundry iron. Eastern Pennsylvania puddling forge in moderate lots has been sold at $16.50, furnace, for prompt and at $17 for first quarter or about $17.50 to $17.85, delivered. Steel-making iron has been quiet. An eastern Pennsylvania consumer took 1,000 tons of valley basic, first quarter, at slightly under $18.50, delivered. Another consumer is figuring on 3,000 tons, first quarter, which also probably will come from the valleys. Some makers of standard low phosphorus now are quoting $30, furnace, or $32.62, Philadelphia, for last half and have made sales at this price. Several thousand tons have been booked. Leading Lebanon makers ask $32, furnace, first half, and have sold over $38, furnace. Statistics show that November bookings and shipments of the furnaces were very heavy. In eastern Pennsylvania aggregate orders now are over 500,000 tons with stocks about one-seventh or one-eighth as much. Virginia orders total about 280,000 tons and stocks about 140,000 tons. In November, orders increased 40,000 to 50,000 tons and stocks declined 15,000 tons. One large Virginia maker has 175,000 tons in orders, of which 60,000 tons were taken in November. The Topton, Pa., furnace has resumed.

Market Quiet, But Strong

Pittsburgh, Dec. 14.—All grades of pig iron continue their march toward the $20 figure in the Greater Pittsburgh district. Sales the last few days have not involved heavy tonnages and not much definite demand is reported. The Colonial Steel Co. has purchased 5,000 tons of standard basic iron for shipment during March, April, May and June of next year.

Alice furnace of the Valley Mold & Iron Co., Sharpsville, Pa., collapsed Dec. 11, after the burden had slipped. The furnace broke out at the hearth and then toppled to one side. The accident was similar to that of the Clinton furnace, which collapsed several years ago. Contracts for rebuilding the stack have been let and it is expected that work will be completed 90 days hence. W. P. Snyder & Co. have leased the furnace

(*For complete prices see page* 1208.)

for several years, operating it on basic iron.

Iron at $19 Minimum

Buffalo, Dec. 14.—The majority of the producing interests of the Buffalo district have, in the past few days, decided to hold what little available tonnage they have unsold over the first quarter and first half of 1916 at a minimum of $19 for all grades. The established asking price of these furnaces are $19 to $20, covering all grades of foundry iron, malleable, basic and bessemer. Other furnace interests here, however, have been placing on the market a liberal tonnage of resale iron at a minimum in some cases as low as $17. It is expected that this minimum will be advanced shortly, as heavy sales are consuming the stock of iron stacked here in the spring for resale. Until the quotations on this iron is changed the Buffalo price is represented by a spread of $3 per ton, namely, $17 to $20, covering the various grades.

The sales for the week totaled about 25,000 tons, largely resale iron. Owing to the recognized sold up condition of the furnaces of the district, there is not much inquiry for iron on the part of melters seeking to contract for additional tonnages, but on the basis of specifications coming in, plus the urgent demands for early shipments, it is evident that the foundries are becoming more active.

In addition to the sales of 25,000 tons noted for the week, Buffalo interests will be called upon to supply 12,000 tons of pig iron in connection with the contract just secured by the New York Car Wheel Works, Buffalo, for 11,000 tons of cast iron segments for the Fourteenth street tunnel in New York City.

Prices Very Firm

Cleveland, Dec. 14.—The quotation on malleable, basic and No. 2 foundry at the furnace, Cleveland, is still $18, or $18.30, delivered in the city, but there is very little foundry iron to be had. A similar condition prevails in Detroit and at other points along the lakes. At Toledo, the prices are the same as at Cleveland and sales are made in a very conservative way. One Cleveland agency is quoting $19, valley, on basic and $20 on bessemer. There is increasing inquiry for all grades for last half delivery, but furnaces as a rule are not willing to make any quotations and in the few cases in which quotations have been made for delivery after July 1, 1916, they have been so high as to preclude the placing of orders. It seems certain that on account of the higher prices of ore, which will cause an increase of $1.50 a ton in the cost of making pig iron, prices on pig iron will be at least that much higher than present quotations for the last half of next year.

Northern Iron Steady

Chicago, Dec. 14.—Sellers of northern foundry and malleable pig iron are maintaining their price at $18, Chicago furnace. This applies to deliveries to July 1 and some makers are willing to take tonnages through the year at the same price. They are not seeking sales for last half, but all melters who are willing to obligate themselves and cover their probable requirements are being accommodated. The tonnage sold for delivery after July 1 is not yet large, but buying is being carried on fairly well, when the situation is considered.

Announcement last week of an increase of 75 cents per ton on ore for 1916 caused pig iron makers to withdraw quotations temporarily until the situation could be canvassed, but they were restored almost immediately without change.

Southern iron appears to be about 50 cents per ton stronger and no $13.50 iron seems available, the speculative iron which has been a factor for some time apparently being absorbed. Some furnaces are willing to take tonnage at $14, Birmingham, but a number have advanced prices to $14.50, Birmingham, and maintain this firmly.

Lake Superior charcoal iron is in rather a ragged condition, one interest which is nearly sold for first half holding its product at $20.75 to $22.25, delivered, Chicago. Other charcoal iron makers, who have more iron for sale, have not yet advanced to this level and are quoting $19.25 to $20.25, delivered, Chicago. Under the circumstances, charcoal iron sellers are disposing of considerable tonnage, some of which is coming into a territory usually supplied with coke iron from Chicago furnaces. Sales have been made recently in the St. Louis district in competition with Chicago iron.

Prices on Up-Grade

Cincinnati, Dec. 14.—The price of southern Ohio foundry iron continues on the up-grade. The Marting Iron & Steel Co. has advanced its quotations to $17.50, Ironton basis, for No. 2 foundry, for first half delivery, and another large maker is holding at $18 for the same shipment. No basic iron is available for the first quarter from furnaces, but small amounts are being offered by speculators for spot shipment at $18 and $18.50, Ironton. Silvery iron for the first quarter is being held at a premium because of its scarcity. The scheduled price for the second quarter is $25, furnace, for 8 per cent silicon. Bessemer ferrosilicon is strong at $28, furnace, for from 10 to 11 per cent.

Two southern stacks are asking $14, Birmingham basis, for No. 2 foundry iron, for the first half, but the remaining furnaces are holding at $14.50 for the same delivery, and one has advanced to $15. Inquiries are light, but sales are being made regularly by salesmen to old customers. Michigan melters have taken 5,000 tons of foundry grades and 5,000 tons of malleable iron. A Kokomo, Ind., user has purchased 2,000 tons of foundry iron, and a local manufacturer has closed for 2,000 tons of northern and southern foundry iron.

Inquiry for Malleable

St. Louis, Dec. 14.—The most interesting inquiries before this market are for malleable iron, one for 3,000 tons, which made its appearance today, and one for 1,000 tons, which was put out last week, and has not been closed. The 3,000-ton inquiry is for delivery over the last half.

Sales last week were confined to a few car lots, mostly of southern iron. Local agents are not expecting a buying movement to take place until after the stock-taking period. Southern No. 2 is quoted by some furnaces at $15, Birmingham, but others are making a price of $14.50. Northern iron seems to be dull, with Chicago quoting $18 and Ironton $17.

Warehouse Stocks

Are Somewhat Depleted Owing to Heavy Demand

Chicago, Dec. 14.—Although warehouses have not yet found themselves in acute need, heavy demand on many finished steel products has depleted assortments in a number of items and mill deliveries are barely sufficient to keep them supplied. Plates, shapes and bars remain at former levels, but black sheets have been advanced to 2.90c, Chicago, and 3.00c, St. Paul. Galvanized sheets, No. 22 gage and lighter, are now quoted at 5.00c and No. 20 gage and heavier at 4.80c, Chicago. Increasing scarcity of the lighter gages is responsible for this unusual division.

Buffalo Prices Higher

Buffalo, Dec. 14.—Warehouse prices have been advanced with the increase in the demand on the mills. Bars and small shapes, under 2 inches are now quoted at 2.45c, f. o. b. Buffalo, with 5 cents per 100 pounds additional for store-door deliveries. Rounds and squares, 2 inches and over, continue to be quoted at 3.15c.

(For complete prices see page 1208.)

Iron Ore Sales

Are Being Made Rapidly by the Lake Superior Producers

Cleveland, Dec. 14.—Sales of iron ore have been made rapidly during the past week at an advance of 75 cents over the 1915 prices. Furnace owners knew, of course, that an advance of $1 was being considered and they are satisfied with the present schedule. Owing to the strength of the pig iron market and the prospects for continued demand during next year, it is expected that furnaces will cover for their full requirements. The new schedule is as follows: Old range bessemer, $4.50; Mesabi bessemer, $4.20; old range non-bessemer, $3.75; Mesabi non-bessemer, $3.55.

M. A. Hanna & Co. are fortifying their already powerful position in the vessel trade by the acquisition of additional tonnage. Last week they purchased the steamers Charles Weston, D. B. Meacham, J. G. Munro and James Corrigan from the Frontier Steamship Co., and the steamer Wm. A. Rogers from the Niagara Transit Co. The vessels are all modern and are of the largest type, having a combined capacity for moving 70,000 tons per trip. In addition to this, this firm will operate the steamers Charles O. Jenkins, Sir Thomas Shaughnessy and F. B. Squire, and also will operate the vessel now on the stocks which is building for the Donner Steel Co. These additions strongly entrench this company, which has the freightage of the ore from the Great Northern properties.

The following are the official dock figures for the Lake Superior ore movement by upper lake ports for the season just closed:

Port.	Season 1915.	Season 1914.
Escanaba	5,649,289	3,664,451
Marquette	3,099,589	1,755,726
Ashland	5,146,772	3,363,419
Superior	8,342,793	11,309,748
Duluth	15,437,419	6,318,291
Two Harbors	8,642,942	5,610,262
	46,318,804	32,021,897
1915 increase	14,296,907	.....

This total of 46,318,894 tons in 1915 compares with previous years as follows:

	Tons.
Season 1906	37,513,595
Season 1907	41,288,755
Season 1908	25,427,094
Season 1909	41,683,873
Season 1910	42,620,201
Season 1911	32,130,411
Season 1912	47,435,777
Season 1913	49,070,478
Season 1914	32,021,897
Season 1915	46,318,804

Busy Toledo Plant.—The Boerder Process Steel Co., Toledo, O., is now very busy making high grade steel products, including ball bearing steel, die steel, spring and machinery steel and non-magnetic steel. The demand is very active, but the Toledo company is promptly filling orders.

Coke Stronger

Prices for Prompt Delivery Are Advanced Sharply

Pittsburgh, Dec. 14.—Conjested traffic conditions and the approach of the holidays which will cause a cessation of operations at many plants in the upper and lower Connellsville regions have caused prices of Connellsville fuel for spot delivery to advance sharply this week. Some furnace coke has been sold at $3.35, ovens, or $1 a ton above the price prevailing a week ago. Foundry coke is being held at $3.75 by some makers for prompt delivery. Whether advanced quotations will be maintained after the situation becomes more nearly normal remains to be seen. No large contracts have been placed this week. The *Connellsville Courier* for the week ending Dec. 4, says production was 437,251 tons, an increase of about 5,000 tons compared with the week previous.

Foundry Coke Strong

Cincinnati, Dec. 14. — Foundry coke from the New River, Pocahontas and Wise county fields is unchanged in price despite acute shortage in production and deliveries. It is quoted at from $3 to $3.25, ovens. Local foundries are not consuming as much fuel as they were two months ago, because the strike of union machinists has caused machine tool builders to withhold deliveries of castings. Connellsville foundry coke has advanced slightly, being now quoted at from $3.25 to $3.50, ovens, and Connellsville furnace grades are being held at from 3 to $3.25, ovens. New River coke is quoted the same as that from the Connellsville district.

Wire Mills Sold Up to July 1

Pittsburgh, Dec. 14.—Wire manufacturers in western Pennsylvania and eastern Ohio practically have been forced out of the market for delivery the first six months of next year. Much of the tonnage now being rolled was sold on the basis of 1.65c and 1.70c for nails. Heavy tonnages are being shipped to England, although shipments have been reduced considerably because of inability to obtain bottoms at the eastern seaboard. Wire nails are firm at $2 a keg. Wire rods nominally are quoted at $40, Pittsburgh.

(For complete prices see page 1208.)

Billets Advance

Scarcity More Serious—Some Very High Quotations

Pittsburgh, Dec. 14.—Sales of billets and sheet bars the last week or 10 days indicate that prices have advanced $1 a ton or more. Sheet bars are being held at $32 and billets at $31 by some makers. The scarcity of semi-finished products is more acute than at any time during the last six months. Most consumers have covered first quarter requirements and reservations have been made for the bulk of the output the second quarter of 1916.

Billets Still Advance

Philadelphia, Dec. 13.—On ordinary open hearth rolling billets, $40, mill, for second quarter, has been quoted within the week by eastern Pennsylvania makers. This is a new high mark for this grade of steel. Consumers who heretofore have been unwilling to use bessemer steel for certain purposes, but upon being forced to do so, have experienced good results, they report, now are renewing their orders and makers say they can obtain $35 and more, Pittsburgh, for billets of this quality. For forging billets, $55, mill, is obtainable, but there is practically no such steel to be offered for many months. Some leading eastern Pennsylvania sellers of billets have been putting all their surplus steel into large rounds, blooms, etc., at very lucrative prices and consequently are out of the market. A local middleman inquired this week for 500 tons of crop ends. Prices have been cabled on the 25,000 tons of billets asked by the French government, but there has been no decision. Some large inquiries for shell blooms are pending.

Ferro is Higher

Pittsburgh, Dec. 14.—Several dealers are asking $110, seaboard, and above for ferro-manganese for prompt shipment. A small tonnage, it is reported, commanded $112, seaboard, a few days ago. Demand for 50 per cent and lower grades of ferro-silicon continues heavy and sellers have experienced no difficulty in obtaining advanced prices. Quotations of steelmaking metals are nominal; no sales of importance have been reported for several weeks.

The American Brass Co., Waterbury, Ct., has handed over to certain employes a check calling for the payment to them of a bonus of 10 per cent of their yearly wages.

Steel Bars Sold to July

Large Inquiries for Shrapnel Rounds Still Pending, But Foreign Demand Largely for Crude Steel

Philadelphia, Dec. 13.—Heavy foreign inquiries for 3¼ to 3½-inch on the shrapnel sizes of rounds now appear to have given way to requests for prices on blooms, billets, forgings, etc., for 8 and 9-inch, or the high explosive shells. It is reported that foreign works now are in a position to supply most of their own needs of shrapnel bars. Some large inquiries for the shrapnel rounds still are receiving attention, including one for 50,000 tons for export put out through New York, but the number is smaller. There are some heavy inquiries for blooms and other forms for high explosive shells, including one for 40,000 tons, another for maximum requirements of 200,000 tons and others. Those buying will take delivery during the last half, or as the makers are able, which means practically the same thing with eastern mills now sold up to July 1 and not quoting at present. A Baltimore shell maker asks 2,200 tons of cold rolled shafting. Makers of soft steel bars continue to take practically no new business and are straining their capacity to make deliveries against current specifications. Producers state they could obtain 2.50c, Pittsburgh, for prompt shipment and the lowest quotation received by an eastern buyer this week for prompt bars was 3.00c, mill. The Norfolk & Western railroad is inquiring for its last half needs, about 3,000 tons. Shafting is up 2 points to 50 and 45 off.

Bars Strong

Pittsburgh, Dec. 14.—Steel bars and iron bars reflect decided strength. Most manufacturers are refusing to sell plates, shapes or bars, except for specific work and not much speculative tonnage has been obtained. Steel bars for shipment at the convenience of the mill, continue to be nominally quoted at 1.70c; an advance of $2 a ton is expected before the end of the year. Bar iron is held at 1.90c by makers in this district.

Continue Scarce

Chicago, Dec. 14.—Increasing difficulty is being experienced by consumers in obtaining their necessities in steel bars. Larger mills are unable to promise any delivery within reasonable time and the few smaller mills which can produce some tonnage for prompt delivery are obtaining large premiums for their service. A nominal quotation of 1.99c, Chicago mill, prevails, but it is practically meaningless, inasmuch as there is nothing for sale for any delivery within several months even at this figure. From 2.29c to 2.44c, Chicago, is being obtained on such tonnage as is being bought for reasonably prompt delivery.

Selling Conservatively

Cleveland, Dec. 14. — Some companies are now quoting 1.80c, Pittsburgh, on plates, shapes and bars, but are not making definite promises of delivery. No delivery prior to July 1 is assured. A few companies are unwilling to take on any bar business and the buyer has difficulty in placing orders, except from warehouse.

Bar Iron Advanced

Chicago, Dec. 14.—Bar iron now is on a basis of 1.75c, Chicago mill, without a sign of weakness. At this advanced figure, mills are contracting for delivery within 60 days. One large consumer is not in the market except for occasional unsually attractive tonnages for immediate delivery, but other makers have considerable tonnage to sell. Conditions indicate that premiums over this quotation will be offered shortly, as the pressure for iron is increasing as steel plates recede.

Much higher prices of scrap going into bar iron is one of the factors making for firmness.

Bar Iron Sells High

Philadelphia, Dec. 13.—Sales of bar iron for early shipment have been made by eastern Pennsylvania makers at 2.10c, mill. The general mill price remains 1.80c, Pittsburgh, or 1.959c, Philadelphia. The market is very strong with good buying.

Hoops, Bands and Shafting

Pittsburgh, Dec. 14. — Prices of hoops and bands have not been changed, despite reports to the contrary. Hoops are quoted at 1.90c and bands at 1.70c. Cold rolled steel shafting is quoted at 50 per cent off the list for carload lots and at 55 per cent off the list for less than carloads.

Plate Mills Are Filled

One Leading Company Practically Retires from Market, But Some Buyers Consent to Cancellations

Philadelphia, Dec. 13.—One leading eastern Pennsylvania maker of plates now has practically withdrawn from the open market as a seller in an effort to free itself from the overwhelming mass of orders upon its books which has continued to grow despite the asking of unusually high prices. Where prices are being named to other buyers than preferred and largest customers, they are at 2.50c, Pittsburgh, for delivery at the mill's convenience, which is aimed to shut off the business. Other eastern makers of plates continue to quote and enter orders at from 2c to 2.25c, Pittsburgh, depending on the tonnage and delivery. Where the larger mills outside this district have been quoting, their price has been 1.80c, Pittsburgh, for deferred deliveries. Some eastern mills now are cancelling unspecified monthly quotas in contracts which is believed to be the first time this procedure has been followed in this product. A considerable tonnage has been wiped off in this way. The market remains full of new boats. The American Bridge Co. has taken a contract from an eastern ship builder to shape and punch at Ambridge, Pa., 4,000 to 5,000 tons of plates for several Norwegian boats. This steel later will be assembled in the eastern yard. The Carnegie Steel Co. will supply the plates. This is an unusual transaction in ship building work. The Norfolk & Western is inquiring for 1,000 to 2,000 tons of last half shapes and plates.

Some Tonnages Cancelled

Cleveland, Dec. 14. — The minimum quotation of Cleveland mills on plates for early delivery is 2.25c, Pittsburgh, and this is the only kind of business being booked by the Cleveland mills. An eastern company which quoted 2.50c, Pittsburgh, for delivery within four to five weeks, did not make a sale. This is one of the indications that there is some limit beyond which buyers will not go. An interesting feature of the situation is that in spite of the great strength of the market there are many plants that are not busy. In numerous

(*For complete prices see page* 1208.)

cases, unfilled tonnages have been cancelled on account of not being promptly specified and this policy has been acquiesced in by the buyers.

Plates Still Offered at 1.70c.

Pittsburgh, Dec. 14.—Despite contrary reports, the 1.70c price has not been formally withdrawn by leading manufacturers in this district. Books for the third and fourth quarters of next year have not yet been opened, although much of the material under contract cannot be shipped until May, June and July. According to estimates made by mill managers, the bulk of the tonnage now being rolled was sold at about 1.25c and manufacturers will not ship against contracts placed at 1.40c and above until March or April of next year.

Plates Seem Strongest

Chicago, Dec. 14.—Of finished steel products, steel plates apparently are in greatest demand or otherwise stated consumers apparently are in greatest need of this product. The nominal quotation of 1.99c, Chicago mill, is only a starting point in price and some heavy tonnages have been placed recently at figures running up to 2.50c, Chicago. Demand for plates to go into car construction and ship building is keen in addition to necessities for other construction.

Shape Prices Still Vary

But Plain Material is Very High, Considering Dullness in New Building

Philadelphia, Dec. 13.—A considerable spread in structural shape prices continues to be shown among eastern Pennsylvania mills in a market that generally is characterized by strength and by high prices where assured deliveries can be made. Any wide assortment of size requires some months to deliver as certain descriptions cannot be supplied before March and April. Some eastern makers continue to quote 2c, Pittsburgh, or 2.159c, Philadelphia, as a minimum; one producer is naming 1.85c to 2.15c, mill, depending on the size, tonnage and delivery. Special sections still can be obtained at 1.70c to 1.75c, Pittsburgh. First quarter contracts for small tonnages of standard sections were closed this week at 2.25c, Pittsburgh. Some eastern makers report that specifications and new business with them are not so active. The Lenoir City, Tenn., car works is inquiring for about 1,000 tons of angles. The 5,500 tons of steel for the McKeon street pier, this city, still is pending, but it now is thought it will go to the American Bridge Co.

Sold Over First Half

Buffalo, Dec. 14.—Mills and agencies of the Buffalo district report that specifications for material under contract are coming in at a pace that bids fair to establish a new record. Most of the producing interests are sold up over the first half of 1916 and the delivery situation is one of increasing mill congestion. Prices remain at the nominal figure of 1.70c to 1.80c, base, but consumers would readily pay 2c for material where deliveries could be assured by the mills, even during the second quarter.

Shapes May be Advanced

Pittsburgh, Dec. 14.—Structural shapes and plates probably will be advanced to a minimum of 1.80c before the end of the year by leading manufacturers in this district, who are offering material at 1.70c for specific work. Considerable tonnage for second quarter delivery has been sold at 1.80c and some tonnage has commanded 2c and above. The McClintic-Marshall Co. will furnish about 5,000 tons of steel for the new chamber of commerce building at Pittsburgh.

Shops Need Business

Cleveland, Dec. 14. — Building which calls for any considerable tonnage of steel is at low ebb in the Cleveland district and the dullness of the market is remarkable at a time when the prices of plain material are so high and so firm. Some of the structural shops in Cleveland have very little business on hand. The Buick Motor Car Co. is figuring on a new building at Detroit which will call for 2,000 tons of steel.

Structural Tonnage Light

Chicago, Dec. 14.—Buying of structural shapes is light in the west with the building season past and projected development somewhat held back by present high prices and uncertainty of delivery. The largest item taken by fabricators in the past week is 1,200 tons for an electric station and blowing engine house at the plant of the Indiana Steel Co. at Gary, which will be furnished by the American Bridge Co. Other tonnage is small.

(*For complete prices see page* 1208.)

CONTRACTS AWARDED.

Indiana Steel Co., electric station and blowing engine house, Gary, Ind., 1,200 tons, to American Bridge Co.

Western Cartridge Co., sheet brass rolling mill building, East Alton, Ill., 239 tons, to Spuck Iron & Foundry Co.

Truck storage building for the Chicago American, Chicago, 224 tons, to A. Bolter's Sons Co.

Buffalo General Electric Co., new steam-electric power plant, 500 tons reinforcing bars and 950 tons steel sheet piling, to Lackawanna Steel Co., Buffalo.

Castner Electrolytic Alkali Co., Niagara Falls, plant addition, 125 tons, to Buffalo Structural Steel Co.

International-Acheson Graphite Co., Niagara Falls, plant addition, 150 tons structural, to Ferguson Steel & Iron Co., Buffalo.

American Extract Co., Port Allegany, N. Y., new leach-house, 100 tons, to Ferguson Steel & Iron Co.

Chamber of commerce building, Pittsburgh, 5,000 tons, awarded McClintic-Marshall Co.

Two additional stories to the Union Arcade building, Pittsburgh, 1,200 tons, awarded the American Bridge Co., who received the contract for the nine stories now under construction.

Loft building for the Nameloc Realty Co., Twenty-third street, New York City, 1,500 tons, steel contract to Post & McCord, fabrication to be done by the American Bridge Co.

Power house, Wheeling, W. Va., 2,000 tons to the Riter-Conley Mfg. Co.

Loft building at Forty-eighth street and Vanderbilt avenue, New York City, 1,500 tons, to Geo. A. Just.

Marine barracks, Norfolk, Va., 500 tons, to the Penn Bridge Co.

Bridge work for the Southern railroad, 1,300 tons, to the Virginia Bridge & Iron Co.

Nyanza mills, Woonsocket, R. I., 500 tons, to Jones & Laughlin Steel Co.

Second section of the Jamaica avenue elevated railroad extension, Brooklyn, 13,000 tons, to the American Bridge Co., placed by Conners Bros., the general contractors.

Bridge work for the Baltimore & Ohio railroad, 300 tons, to the Mount Vernon Bridge Co.

CONTRACTS PENDING.

Chamber of Commerce, Rochester, N. Y., 600 tons, bids being taken.

Plant for the New York Steam Co., downtown location, New York City, 1,400 tons, bids entered.

Extensions for the Public Service Electric Co., Newark, N. J., 800 tons, bids being taken.

Hudson county jail, Jersey City, 1,500 tons, revised bids to be taken Dec. 20.

Loft building, New York City, for unidentified owner, 3,000 tons, bids being taken.

Additional bridge work for the Southern railroad, 700 tons, bids being taken.

Valuable Lists.—The bureau of foreign and domestic commerce, Washington, has completed a revision of the list of importers and merchants located at Buenos Aires, Bahia Blanca and La Plata, Argentina. The supplement contains 37 pages and is sold for 5 cents per copy. A complete revision and classification of the names of merchants in central America and the West Indies has also been completed. It is sold at 60 cents per copy.

Pig Iron Buying in East

Includes Large Tonnage for Making Subway Segments—November Structural Lettings Make Large Tonnage

New York, Dec. 14.—More tonnage for extended forward delivery is figuring in the pig iron market in this district and a number of sales for third quarter or beyond have been made. Most makers do not care to sell very freely beyond July 1, but there is an increasing interest among buyers for that period. A Troy, N. Y., consumer has closed for 15,000 to 20,000 tons of standard forge from a Buffalo maker and for 5,000 to 10,000 tons additional from a New York state furnace, making its total recent purchases about 30,000 tons, deliveries to run into the third quarter. The price was around $18, delivered. Two Lehigh valley furnaces will supply about 25,000 tons of foundry and forge for New York tunnel segments to be furnished by the Davies & Thomas Foundry Co., Catasauqua, Pa.; Buffalo makers will receive about 12,000 tons for that portion of these segments which has been awarded to the New York Car Wheel Co., Buffalo, while nearby furnaces will fill similar needs of the Wheeling Mold & Foundry Co., Wheeling, W. Va., on the same contract. A Bridgeport, Conn., valve builder has purchased 5,000 to 7,000 tons of high silicon iron for early shipment; a New Britain, Conn., consumer, 2,000 tons of No. 2X for last half, while the International Steam Pump Co., in the week, distributed orders against its inquiries for 14,000 tons, principally foundry, for last half shipment to its various plants. Makers in different districts participated. A soil pipe maker is figuring on 2,000 tons of 2X and 2 plain for last half for Newark, N. J., and the American Locomotive Co. for 600 tons of high silicon. About one-half which is all that is being marketed at this time of the 65,000 to 70,000 tons of speculative iron in the Buffalo district, has been disposed of, it is understood, at from $17.50 to $18, Buffalo. This iron, consequently, is no longer figuring actively in the market.

Cast Iron Pipe

Contracts for the 43,500 tons of cast iron pipe segments for subway tunnels under the East river at Fourteenth street, this city, have been awarded by the general contractors, Booth & Flynn, Pittsburgh. The Davies & Thomas Foundry Co., Catasauqua, Pa., received 21,750 tons, and the Wheeling Mold & Foundry Co., Wheeling, W. Va., and the New York Car Wheel Co., Buffalo, about 10,875 tons each. These companies furnished the last large lot of subway segments for the metropolis. The price at which these castings were awarded was almost 50 per cent greater than at the previous letting.

November Good Month

Structural steel lettings in the country during November were the largest of any month in several years and aggregated 180,000 tons or 105 per cent of fabricated shop capacity, according to the statistics compiled by the Bridge Builders and Structural Society. The bookings were the heaviest of any month since the issuance of these monthly reports was inaugurated. A large tonnage of New York and Philadelphia subway steel helped to swell the total.

The month record of the percentage of capacity contracted for and the approximate tonnage represented is as follows:

Month.	Per cent.	Approx. tonnage.
November, 1915	105	180,000
October	78	135,000
September	67	115,000
August	85	146,000
July	86	148,000
June	80	138,000
May	61	105,000
April	62½	107,500
March	64	110,000
February	30	51,000
January	25	43,000
December, 1914	35	60,000
November	20	35,000
October	35	60,000
September	38½	65,000
August	27½	48,000
July	68	115,000
June	56½	95,000
May	57	97,000
April	88	151,000
March	76	130,000

The French government has inquired through J. P. Morgan & Co. for 12,000 tons of bridge material. Leading fabricators report that the total volume of new work for this season is the best in several years, but new building projects in the metropolis still come out slowly. Some projects are taking form, including one of 3,000 tons for a loft building which is being figured quietly. Mill prices on structural shapes vary considerably in practically each case, and the delivery period usually is the determining factor. Standard sections range from about 2c to 2.25c, New York, with special sections still available around 1.869c, New York.

Ferro-Alloys

Preparations are being made to increase considerably the domestic production of merchant spiegeleisen. The Marshall furnace of the Juniata Furnace & Foundry Co., at Newport, Pa., is about to be blown in for the production of this alloy from zinc residium to be supplied by the New Jersey Zinc Co. It is claimed this furnace will increase the domestic production 8,000 to 10,000 tons, annually. The American Manganese Mfg. Co. also has a second Dunbar, Pa., furnace, ready to be started on spiegeleisen. The consumption of spiegeleisen in this country which has been stimulated by the high price and scarcity of ferro-manganese, continues heavy and makers have a large total of orders on their books. Prices are unchanged at $28 to $30 for 19 to 21 per cent and producers now will accept these figures on shipments throughout the entire year.

The ferro-manganese market continues to show a stronger position and there is a better miscellaneous buying. Leading domestic makers now are holding for $110, furnace, for either prompt or forward delivery or about $108, seaboard, and in the week have refused offers of $100, furnace.

(*For complete prices see page* 1208.)

High Coke Prices

Pittsburgh, Dec. 15. (By wire.)—High prices continue to be paid for Connellsville furnace coke for immediate shipment. Some dealers are reported to have refused to sell fuel at $3.50, ovens, but no sales above $3.35, ovens, have been made in the open market. The accident to the Alice furnace has released a small tonnage of furnace coke which probably will be sold at fancy prices. The contract market is quiet.

Coke Operator Dies

Pittsburgh, Dec. 15. (By wire.)—Abraham Overholt Tinstman, pioneer coke oven operator of western Pennsylvania, died at his home in Turtle Creek, Pa., last week. He was associated with Henry C. Frick for several years.

Frank H. Bailie, assistant sales manager of the H. K. Porter Co., Pittsburgh, died Dec. 14 at his home in that city.

The Connersville Blower Co., Connersville, Ind., manufacturer of gas exhausters and boosters, has received a contract from the United Steel Co., Canton, O., for two cross-compound engine driven gas exhausters for installation at the by-product coke oven plant, contracts for which were awarded to the H. Koppers Co., Pittsburgh, some time ago.

Scrap Prices Very High

Twenty-Dollar Heavy Melting Steel Seems Probable at Pittsburgh—Quotations Generally Advanced

Pittsburgh, Dec. 14.—Twenty-dollar heavy melting steel is being talked of by sellers of iron and steel scrap. Some stock has commanded $18.50, delivered, in this district, although several of the largest consumers are refusing to pay more than $17.50. Consumers are drawing upon stocks accumulated many months ago. All grades of scrap have advanced from 50 cents to $1 a ton this week. Prevailing prices are the highest quoted in many years.

Mixed Scrap Advances

Cincinnati, Dec. 14. — Heavy shipments to rolling mills continue to feature the scrap market. These melters are taking large tonnages of heavy melting steel, No. 1 busheling, and bundled sheet scrap. Large users in the Chicago district are asking for good tonnages of mixed cast scrap with the result that it has advanced to from $10 to $10.50 per net ton. Malleable scrap is also in good demand, and is being held at from $8.50 to $9 a ton. Heavy melting steel is quoted at from $14 to $14.50 per gross ton.

Purchasing Liberally

St. Louis, Dec. 14. — The upward tendency of scrap prices has been unchecked, although a steadier tone has been noticeable within the last few days. Consumers are purchasing liberally and dealers are willing to turn over part of their accumulations at prevailing prices. Railroad lists on the market this week are: Big Four, 3,500 tons; C., St. P., 860 tons; Vandalia, 800 tons; Chicago and Alton, 600 tons; St. Louis-Southwestern, 720 tons; Wabash, 80 tons.

Scrap Marking Time

Chicago, Dec. 14.—Iron and steel scrap, which has risen rapidly for several weeks, apparently has reached a level which does not admit much further advance until conditions change. Large consumers have bought considerable tonnage in recent weeks and probably will not be in the maarket for some time. Some few changes are made from week to week, all in upward direction, but the general advance has been checked.

This market at present is dependent in a large degree on developments at Pittsburgh. The price of heavy melting steel at that center largely dictates the price here and when Pittsburgh pays sufficient to make it profitable to ship heavy melting steel eastward, local mills are forced to meet all competition.

Railroads are continuing to offer more or less tonnage and at present the following lists are active: Michigan Central, 1,800 tons; Northern Pacific, 600 tons, including 2,000 tons of long steel rails and 500 tons of iron bars; Great Northern, 2,500 tons; Chicago, Milwaukee & St. Paul, 1,025 tons, and the Chicago, St. Paul, Minneapolis & Omaha, 830 tons.

Buffalo Sales Heavy

Buffalo, Dec. 14.—Activity in wrought scrap proved to be one of the features of the Buffalo old material market in the past week. Sales totaling fully 15,000 tons are reported. This volume of buying has taken practically all of the available wrought scrap from the dealers of the district. Heavy melting steel continues to be the leader in the trading. Prices on four of the commodities in the list have advanced in the past week including wrought scrap, up $1 and a stiffening of 50 cents per ton is noted in railroad malleable, cast borings and in old iron rails.

Dealers report that the schedule of prices now being quoted is expected to hold without a break for some little time. Any changes in the prices, it is believed, will be upward and not downward. This will be particularly true of the lines influenced by the pig iron market.

Very Strong in East

Philadelphia, Dec. 14.—With No. 1 railroad wrought and cast scrap the leaders in demand among the works, the old material market in eastern Pennsylvania is very strong all along the line and further advances of 50 cents or more a ton have been established. There is very little buying of heavy melting steel, but the brokers are active with offers of $16, delivered. The inactivity of steel among the consumers is attributed largely to the unwillingness of dealers to sell for future delivery and to the fact that the receiving and handling facilities of the works are taxed. At present, an embargo on scrap is in effect at one Coatesville works and others are threatened. The buoyancy of No. 1 railroad wrought is due to a general shortage. This grade continues to sell well over $20, delivered eastern Pennsylvania, and city wrought has been sold at $19, delivered. Wrought pipe was done this week at $15.75, delivered. Cast scrap is in general demand.

(*For complete prices see page* 1208.)

Cast Iron Pipe

Prices Are Again Advanced—City Buying Not Active

Chicago, Dec. 14.—Cast iron pipe prices are advanced again this week 50 cents per ton, making 4-inch $29.50 to $30, Chicago, and 6-inch and larger $27.50 to $28, Chicago.

Cities are not figuring heavily on their requirements for next year's extensions, apparently waiting until their annual appropriations are made before obligating themselves for supplies. Chicago recently bought a heavy tonnage and Minneapolis has placed 250 tons with the American Cast Iron Pipe Co. Bids were opened Dec. 14 at Atkinson, Ill., on 400 tons.

The Crosby Water, Light & Power Co., Crosby, Crow Wing county, Minn., is in the market for 400 tons of standard cast iron water pipe for extensions. The company's main office is at Duluth, Minn.

Nuts and Bolts Again Advanced

Pittsburgh, Dec. 14.—Nut and bolt makers advanced prices from 5 to 10 per cent last week and rivets were put up $2 a ton. Heavy demand for these products, coupled with higher prices quoted by makers of bars, were responsible for the advanced quotations adopted by nut, bolt and rivet manufacturers. The Pittsburgh Screw & Bolt Co. has taken a large contract for furnishing material for battle ships No. 43 and No. 44.

Contracts Declined

Chicago, Dec. 14.—Makers of bolts and nuts have announced a new schedule, advancing prices. Demand for this product has been strong from all sources and mills are well filled and have been forced to decline some offered contracts. The increase affects all items.

Christmas Entertainment.—The December meeting of the Pittsburgh Foundrymen's Association will be held Dec. 20 at the Fort Pitt hotel. The committee in charge of the meeting plans to provide a Christmas entertainment. Bayard Phillips, of the Phillips & McLaren Co., chairman of the membership committee, has inaugurated a campaign to increase membership by not less than 50 names before the end of the year.

Sheets Are Strong

But Market Not Very Active—Uncertainty as to Sheet Bars

Youngstown, O., Dec. 14.—Manufacturers of steel sheets say that preholiday dullness is beginning to affect demand for nearby delivery material, although some heavy inquiries have come into the market the past few days for second quarter shipment. Because of the uncertainty of future steel prices, little second quarter sheet business has been booked. Prompt quotations for sheets have strengthened the past week, although the minimum of 2.25c for blue annealed, and 2.50c for black sheets has not disappeared. The galvanized sheet market continues in a state of demoralization, which the recent strengthening of spelter prices has only served to accentuate. Quotations are extremely irregular; some mills have withdrawn entirely from the market, while others are quoting on the basis of the cost of spelter, so that their quotations vary from day to day, and range from 5c, Pittsburgh, up.

Sheet producers seem little worried about the supply of sheet bars, although they do not venture to predict the levels bar prices may reach after the next few months. Consumers of semi-finished steel generally are covered for the first quarter, while they will not start buying for the second quarter until after Jan. 1. In the interim, the semi-finished market is on a vacation. Producers say "there is no market." Mills have no material to sell. As there are no sales, quotations on both bessemer and open hearth steel are nominal.

Strong at Chicago

Chicago, Dec. 14.—Conditions in the sheet market have not changed recently and No. 28 gage black is still quoted at 2.69c, Chicago, and higher, according to delivery and attractiveness of specifications. Galvanized sheets are most uncertain with tonnages moving at 4.75c to 5.25c, Chicago, according to the ideas of mills and according to their supply of spelter. Demand is not strong and while prices are firm, there is not as much tendency toward upper levels as in other steel products.

Sheet Prices High

Cincinnati, Dec. 14.—The sheet market continues strong. Nearby mills are not seeking business and are asking extremely high prices. Black No. 28 gage are being held at 2.65c and galvanized No. 28 gage at 5c, both Pittsburgh basis. Transactions are all for spot delivery, as mills will not quote extended shipments. Sales are heavy considering the uncertain condition of the market. Warehouse prices are as follows: Black No. 28 gage, 3c; galvanized No. 28 gage, 5.25c; blue annealed No. 10 gage, 2.65c, all Cincinnati basis.

Blue Annealed Strong

Cleveland, Dec. 14.—Cleveland makers are able to obtain 2.50c, Pittsburgh, on No. 10 blue annealed, but a seller quoting 2.75c on No. 28 black did not take the business. There is strong demand for sheets from automobile manufacturers.

Deliveries More Deferred

Pittsburgh, Dec. 14.—Specifications for steel sheet products are increasing in volume and shipments are more deferred each week. Most mills have sold material for shipment the first and second quarter of next year and many consumers covered needs before prices reached their present levels. No. 28 gage galvanized sheets are selling at 4.75c and above and No. 28 gage black sheets are commanding from 2.50c to 2.75c. Mills are operating at approximately 90 per cent of capacity.

Higher Sales in East

Philadelphia, Dec. 13.—Sales of blue annealed sheets have been made by eastern makers at $2 and $4 higher than the recognized market level of 2.40c, Pittsburgh, or 2.559c, Philadelphia, for No. 10 gage. No change, however, has been made in their minimum schedules by eastern makers. The largest buyers are being quoted on the 2.40c, Pittsburgh, business. The demand continues very brisk.

Foreigners Want Tin Plate

Pittsburgh, Dec. 14.—Inquiries for tin plate for shipment to South American and far-eastern countries are numerous and involve decidedly heavy tonnages in the aggregate. Considerable material for export is commanding slightly above the domestic price. It is not improbable that the prevailing price, $3.60, will be advanced $2 or $3 a ton in the near future. Much of the tonnage now being rolled was sold at comparatively low prices to consumers who covered first quarter needs before mills formally opened books for 1916 delivery.

Pipe More Active

Pittsburgh, Dec. 14.—Demand for tubular goods is heavier. Specifications for oil country material are coming out in rather heavy volume. An order for 50 miles of 8¼-inch line pipe, involving about 2,700 tons, for southwestern shipment, was distributed among mills in the Greater Pittsburgh district a few days ago. Demand for boiler tubes continues decidedly heavy and premium prices are being obtained by some mills for prompt delivery.

(*For complete prices see page* 1208.)

Safety First

Will Be Rule in Filling Very Large Order for Alliance Cranes

The large order recently placed with the Alliance Machine Co., Alliance, O., by the Illinois Steel Co., covers 71 cranes, and are intended for the plants at South Chicago and Gary. The order is for heavy duty, up-to-date mill type cranes of various sizes and capacities, such as are used in plants of this magnitude. These cranes are to be designed and built throughout with special reference to the features of safety, strength and durability, and must be the most modern construction possible throughout to meet the exacting demands of these plants.

Among the cranes included in this order are: Four 175-ton four-girder ladle cranes, eight 100-ton four-girder ladle cranes, four 150-ton screw type strippers, four 7½-ton open hearth charging machines and four 15-ton slab charging machines, the rest of the entire lot being made up of bucket cranes and mill handling cranes of all kinds.

The cranes are all to be specially constructed with every possible safety feature, and with safety cables and interlocking devices on the ladle cranes, so as to afford every means of protection against loss of life and damage to property.

It is notable that over two-thirds of these cranes are to be duplicates of cranes that have already been furnished by this company for these same plants and which have been in very successful operation for a number of years.

To complete this order, the manufacturers will require approximately 4,000 tons of structural material, which is to be purchased from the United States Steel Corporation.

The total shipping weight of the 71 cranes will be in the neighborhood of 15,000,000 pounds and the total horsepower of the motors required to operate them will be approximately 12,500. It will require from 400 to 450 cars to handle the shipment covered by this order.

It seems but a few years since that a crane order of this kind and of this magnitude was equal to the capacity of any one plant of the

crane builders for almost a year, but with the present equipment of the Alliance Machine Co., and the additions it is now making of a building 120 x 380 feet as well as the machine equipment it has purchased, it is doubling the output and making it possible to deliver this order in approximately four months, had it been required in this time. However, it expects to be able to complete shipment of this entire order in six months from the date the order was booked.

Light Rails

Advanced at Chicago Following Action at Pittsburgh

Chicago, Dec. 14.—Following an increase at Pittsburgh, the Chicago mill producing light rails has advanced prices $2 per ton, bringing this market again in line with the eastern situation. A difference of about $2 per ton has existed for some months, the Pittsburgh mill being higher. Track fastenings remain firm at high levels with buying moderate, which is in keeping with the season. Spikes are quoted at 2.10c, plates at 2.50c to 2.60c and tie plates at $36.

Car Inquiries Active

Chicago, Dec. 14.—Inquiries by the Missouri, Kansas & Texas railroad for 2,000 gondolas and 500 box cars and by the Lehigh Valley railroad for 500 box cars are becoming quite active and it is believed they will be closed within a few days.

Locomotive Orders

The Monongahela railroad has ordered six superheated consolidated locomotives from the American Locomotive Co. The Youngstown Sheet & Tube Co., Youngstown, has ordered one 4-wheel switch engine from the Baldwin Locomotive Works. The Akron & Barberton Belt Line has ordered one mogul type locomotive from the Baldwin company.

Youngstown Sheet & Tube Contracts

The following contracts have been awarded for extensions and improvements being made by the Youngstown Sheet & Tube Co.:

To the Pennsylvania Engineering Works, New Castle, Pa., a 1,300-gross ton hot metal mixer, to be used between the blast furnaces and open hearth plant.

To the Wheeler Condenser & Engineering Co., for three cooling towers for the gas cooling water at the coke plant. Each tower will have a capacity of 3,000,000 gallons per 24 hours, and will reduce the water from 130 to 85 degrees with 80 degrees atmosphere and 70 per cent humidity.

Many Names

Submitted for Membership in Iron and Steel Institute

New names offered for membership in the American Iron and Steel Institute have exceeded the constitutional limit which is 1,500, divided into 1,250 active members and 250 associate members. Before the meeting of the directors at New York, Friday, Dec. 10, only five vacancies remained in the active list and 46 in the associate list. There were 35 nominations for new memberships. Of these, about 25 were eligible for active membership and the other 10 for associate membership. The directors discussed two plans for meeting the situation, one to increase the active list by 100; the other to elect temporarily as associate members all but five of those eligible for active membership. In view of the fact that the institute meetings have grown so large that it is difficult to find hotels outside of New York City capable of accommodating them, it was decided not to increase the membership lists. At the same time, it was decided not to keep the nominees who are eligible for active membership on the waiting list. It was decided to elect in the order of priority of application five of the nominees as active members and the remainder as associate members. Those eligible for active membership, who were placed temporarily in the associate list will be transferred to the active list as vacancies occur.

Will Build Bridge

Indianapolis, Dec. 14. — J. W. Coneys, division superintendent in this city of the Pennsylvania Lines, announced that he has received word that the company expects to proceed immediately with plans for the construction of a two-track railroad bridge over the Ohio river between Louisville, Ky., and Jeffersonville, Ind. The structure will cost about $2,500,000. The bridge will be an overhead structure of steel and will be more than a mile and a half in length.

The plant of the Driggs-Seabury Ordnance Corporation at Sharon, Pa., was practically shut down last week as a result of a strike said to have been caused by the discharge of several employes.

(For complete prices see page 1208.)

Snyder Furnace

Will Be Operated by the Electric Steel Co. of Chicago

Chicago, Dec. 14.—A new development in the steel castings industry in Chicago is marked by the organization of the Electric Steel Co. The only electric furnace now operating in Chicago is of the Heroult type, melting steel for large castings. Other jobbing steel foundries produce their output by the use of converters. The Electric Steel Co. will operate a Snyder electric furnace and its output will be confined to small castings of superior quality, especially of alloy steel.

Officers of the Electric Steel Co. are: President, Charles Piez, president Link Belt Co.; vice president, John M. Olmsted, Link Belt Co.; secretary-treasurer, P. L. Coonley, vice president Link Belt Co. The directors are: W. C. Frye, Sivyer Steel Casting Co., Milwaukee, and Federal Malleable Co., Milwaukee; C. R. Messinger, vice president Sivyer Steel Casting Co.; Charles Piez, P. L. Coonley and John M. Olmsted.

In order to begin operations without delay and offer quick deliverey, the company has leased a plant at Thirty-first and Wood streets in the heart of the central district, formerly occupied by the Wildman Boiler Works.

This company has the advantage of unusual experience in heat treatment of steel, the experimental study of which has proven of vital importance in successfully making that class of high grade light weight castings which requirements of the past few years have developed.

A heavy order book awaits the beginning of operations, a large proportion of the company's output for several months being contracted already, although deliveries will not be possible until the middle or latter part of February. The Link Belt Co. has operated a Zenzes steel converter for a number of years at its plant in Thirty-ninth street, Chicago, gaining considerable experience in making steel castings. Mr. Frye and Mr. Messinger, through their active connections with the Sivyer Steel Casting Co., have had large experience.

The old Mallory steamship yard, at Mystic, Conn., has been acquired by a new company, the Continental Trading Co., and is being rehabilitated to again engage in the ship construction business. This company is understood to have taken contracts for several vessels for Norwegian shipping interests.

Merger Options Are Signed

By Large Percentage of Stockholders of Youngstown Sheet & Tube Co.—Cambria Stock Also Optioned

Youngstown, O., Dec. 14.—Negotiations in the proposed Youngstown Sheet & Tube - Cambria - Lackawanna merger are beginning to assume definite form. Stockholders of the Sheet & Tube Co., at a special meeting in the company's offices in the Stambaugh building this afternoon, heard the various phases of the proposition presented by President James A. Campbell. During a three-hour session, the plans were discussed informally with some little opposition, understood to have been on the part of some of the older stockholders. The meeting was adjourned sine die. Mr. Campbell immediately afterwards stated to *The Iron Trade Review:*

"The plans still are in a preliminary state. Options either have been signed or promises made by mail to sign on from two-thirds to three-quarters of the stock. Inasmuch as it may be months before everything is settled in connection with the proposed merger, the Youngstown Sheet & Tube Co. is going right ahead with its policy of expansion. The directors of the company, at their meeting today, authorized the construction of an additional 500-ton blast furnace, on the south side of the Mahoning river, adjoining the battery of 204 by-product coke ovens now under construction."

As to the details of the proposed merger, little information has leaked out to the general public. It is understood in Youngstown business circles that Frank A. Vanderlip, president of the National City Bank of New York, and E. T. Stotesbury, a member of the Morgan Philadelphia house of Drexel & Co., will be directors of the new corporation, while rumor has it that Mr. Campbell is slated for the presidency.

Options already have been secured on Cambria Steel stock at 80, while Lackawanna stockholders will be heard from this week. It is not known at what price Lackawanna Steel will be optioned, which accounts for the wavering of this stock on New York stock market between 80 and 85, in the past week. It is proposed to Sheet & Tube stockholders that each sign an option running to Jan. 31, 1916, at $300 a share.

Owing to the recent activities of Mr. Vanderlip and other eastern financial interests in the recently organized American International Corporation, and their connection with the steel company merger negotiations, Youngstown steel men believe that the purpose of the merger is to effect greater economy of distribution, especially in respect to foreign trade. It is said the new combination, which will have a working capital of $25,000,000 to start, will acquire or build steel plants at Chicago and Philadelphia.

Republic Not Included

Chairman John A. Topping, of the Republic Iron & Steel Co., has denied that his company is concerned in a merger of independent steel companies now the subject of negotiations among various companies, among which commonly have been mentioned the Cambria and Lackawanna Steel companies, the Youngstown Sheet & Tube Co. and the Newport News Shipbuilding & Dry Dock Co. Some of these reports have connected the name of the Republic company with these plans. "Merger rumors concerning the Republic Iron & Steel Co. and other steel interests," said Mr. Topping, "are without any foundation whatever. Under existing conditions the possibilities in this direction are not only remote but in my opinion the period is inopportune considering the interests of the stockholders of the Republic Iron & Steel Co."

Will Deal in Machine Tools

The Poole Engineering & Machine Co., of Baltimore, has taken out a Delaware charter with a capital of $3,000,000, to manufacture, sell and deal in machine tools, ordnance, munitions, etc. The incorporators are: S. Proctor Brady, German H. H. Emery, Eli Frank and J. Harold Wheeler Jr., all of Baltimore. According to a report from Baltimore, this company just has taken a contract for furnishing shells and one-pounder machine guns, valued at $12,500,000.

Will Reduce Rates

The Louisville & Nashville and other railroads have agreed to reduce rates on pig iron from southern furnaces to Nashville, Tenn., as the result of a complaint made by Gray & Dudley, the Allen Mfg. Co. and other Nashville consumers. The new rates are to be published in 30 days. The interstate commerce commission, which has been investigating the complaint, held a hearing at Nashville to consider the subject of reparation.

Guns for Allies

The Marlin Arms Corporation, capitalized at $3,500,000, under the laws of New York, which has just taken over the Marlin Fire Arms Co., New Haven, Ct., has signed an agreement with the Colt's Patent Fire Arms Mfg. Co., Hartford, Ct., to make its machine guns of 1914 model, and has closed a $10,000,000 contract with J. P. Morgan & Co., New York, to furnish 10,000 guns for the allies, delivery to begin in February. By the agreement the new corporation organized Dec. 8 gets a license to make the Colt gun, for which it is to pay royalties and the Colt Co. is to furnish every possible assistance in the way of expert advice, working drawings, analysis, tools, etc. The Colt Co. is to receive a royalty of about 15 per cent, which would amount to about $1,000,000 if the delivery of the 10,000 guns is accomplished.

Lake Erie Ore Receipts

Out of a total shipment of 4,445,129 tons of iron ore during November, 4,308,295 tons were received at Lake Erie ports, distributed as follows:

Port.	November, 1915.
Buffalo	600,879
Port Colborne	24,934
Erie	138,165
Conneaut	725,295
Ashtabula	1,066,031
Fairport	188,834
Cleveland	948,249
Lorain	301,030
Huron	60,833
Sandusky	.....
Toledo	201,745
Detroit	52,300
Total	4,308,295

Takes Over Engine Works

The Reliance Engineering Co., Lansing, Mich., has taken over the Seager Engine Works, of that city, and will continue the manufacture of the Reliance line of cream separators, making them in very much larger quantities than formerly. The company will also continue the manufacture of gas and gasoline engines. The company has discontinued its selling arrangements with the Rumely Co. The officers of the Reliance Engineering Co. are: C. P. Downey, president; F. L. Smith, vice president; E. C. Shields, secretary, and J. W. Wilford, treasurer and manager.

MEN OF THE IRON TRADE

Who they are **Where they are** **What they are doing**

Edgar Palmer, president of the New Jersey Zinc Co., has been made a director of the National City Bank, New York City.

Henry R. Hayes has resigned as a director of the Electric Properties Corporation and of Westinghouse, Church, Kerr & Co.

Arthur F. Clough, assistant advertising manager of the Norton Co., Worcester, Mass., states that the report that he has tendered his resignation is not correct.

W. C. McGraw, who has been attached to the Philadelphia office of the Republic Iron & Steel Co., has been transferred to the Detroit office of that company, where he will act as a salesman.

A. C. Dinkey, president of the Midvale Steel & Ordnance Co., also is serving as president of the Worth Bros. Co., Coatesville, Pa., which now is a subsidiary of the latter corporation.

F. P. Palen, assistant to President H. L. Ferguson of the Newport News Shipbuilding & Dry Dock Co. and manager of the New York office, has been elected a vice president of the company.

Dr. J. A. Udden, geologist of the bureau of economic geology, University of Texas, Austin, has been appointed director of the bureau, the former director, Dr. Wm. B. Phillips, having resigned to become president of the Colorado School of Mines.

John Milne, senior partner in the firm of Burrow, Stewart & Milne, of Hamilton, Ont., one of the oldest stove manufacturing firms in Canada, who has taken a prominent part in political affairs, has been appointed a member of the Canadian senate.

J. Norman Sherer, of Bellefonte, Pa., has been appointed superintendent of the furnaces of the Reading Iron Co., Reading, Pa., succeeding Albert Broden, who resigned recently to become identified with the new owners of the Temple, Pa., furnace.

John M. Bryce, who was a foreman of the ball bearing department of the New Departure Mfg. Co., Bristol, Ct., has become general superintendent of the Abbott Ball Co., Elmwood, Ct. Charles M. Bowen, assistant foreman has been promoted to fill the vacancy.

Wilmer Penrose, formerly with the Inland Steel Co., has been placed in charge of a new office, opened at 1110 Holbert building, San Francisco, by Shimer & Co., 672 Bullitt building, Philadelphia, dealing in Dunbar, Pa., furnace products, including ferromanganese, manufactured by the American Manganese Mfg. Co.

J. F. Snarenberger, who has been assistant manager of the Louisville branch of Fairbanks, Morse & Co., for the past six years, has been appointed manager to succeed George B. Woodward, manager of the branch, who has resigned from the service of the company after a connection extending over nearly 50 years.

J. P. Coonahan has been made assistant purchasing agent of the Midvale Steel & Ordnance Co., with office in the Widener building, Philadelphia. Mr. Coonahan acted in a similar capacity for the Midvale Steel Co. A. L. Murphey, who was purchasing agent for the Midvale Steel Co., continues to hold that office for the Midvale Steel & Ordnance Co.

Marcus A. Coolidge, president of the Fitchburg Machine Works, Fitchburg, Mass., has been elected mayor of that city on the independent citizens' ticket by a margin of 20 votes in one of the hottest municipal campaigns in the history of the city. There was a celebration of the event the night of Dec. 7, at which 500 employes of the works took part.

Charles E. Duncan, newly appointed general manager of the Donner Steel Co., Ltd., has arrived in Buffalo from his home in Johnstown, Pa. He is quoted as saying rehabilitation of the plant will be started in two weeks. Mr. Duncan was superintendent of the old Cambria works. Previous to that he held positions with the Carnegie Steel Co., and was superintendent of the Algoma Steel Co.'s plant at Sault Ste. Marie.

Ralph H. Sweetser, president of the Thomas Iron Co., Easton, Pa., whose able and progressive management of the affairs of that company since he took hold of them several years ago, has gained for him a prominent position in the pig iron industry, especially in the east, has been honored by his election as president of the Eastern Pig Iron Association. He succeeds Ledyard Heckscher of the Alan Wood Iron & Steel Co., who served at this post during the past year. The election took place at Philadelphia on Dec. 8. Mr. Sweetser became president of the Thomas Iron Co., on August 1, 1913, coming to that position from the Columbus Iron & Steel Co., Columbus, O., where he had served as superintendent. Previous to that time, he had been identified with various other blast furnace companies.

Woolsey McA. Johnson, Hartford, Conn., is now consulting metallurgical engineer for the American Spelter Corporation, New York, with works at Kusa, Okla.

Benjamin F. Jones Jr., president of the Jones & Laughlin Steel Co., Pittsburgh spoke in favor of a protective tariff at a meeting of the Americus Republican Club, at Pittsburgh, Dec. 11.

James A. Farrell, New York, president of the United States Steel Corporation, was a guest of the Fairweather club at its fifth annual meeting and dinner in Washburn hall, Worcester, Mass., last Saturday night. The club is a part of the Worcester district organization of the American Steel & Wire Co., and has associate members in practically every city in the United States where agents are located. Mr. Farrell is an honorary member.

Chas. A. Odegaard, for the last seven years connected with the Marshall & Huschart Machinery Co., of Chicago, as salesman and correspondent, has severed his connections with that company and affiliated himself as secretary with the Federal Machinery Sales Co., No. 12 North Jefferson street, Chicago, a notice of whose organization recently appeared in this paper. James Jay Sheridan has resigned as secretary, but retains his directorshop in the company.

George A. Cragin, Worcester, Mass., assistant general sales agent of the American Steel & Wire Co., under general sales agent Frank Baackes, Chicago, who, for the past seven years has been in charge of the New England territory, has resigned. He says he has no future business plans. Mr. Cragin was in the employ of the company and its predecessors, 35 years, starting in as an office boy with his father in Chicago. He is a recognized authority on electrical wire and a past president of the Electrical Manufacturers' Club.

Iron and Money: Fact and Comment

Wall Street Has a Rather Depressing Week in Spite of Favorable News

IN SPITE of the splendid showing of a gain of over 1,000,000 tons in unfilled orders by the Steel Corporation and some other favorable news, the stock market was weak most of the time during the past week, and with the exception of Republic Iron & Steel, few of the leading steel companies made a net gain for the week. The assembling of congress, the strained relations with Austria and the decline in Anglo-French bonds were blamed to some extent for the weakness. The railroads continue to show large gains in earnings.

In the early part of the week, professional traders had some success in depressing the market. This was true on Monday, but conditions improved in the final hour of the session. The presidential message was pretty well forecasted and its delivery did not have any marked effect on the market Tuesday. Some of the propositions of the President were unpopular. During the latter half of the week, there was no decided change, and at the close, a number of the stocks developed strength.

Quotations at the close of business Dec. 11 and changes in the leading stocks identified with the iron and steel business for the week are shown in the following table:

	Close Dec. 11.	Net chg.
American Can	60	—1¾
American Can, prfd.	112	+2
Amer. Car & Fdy. Co.	79¾	+1⅝
Amer. Car & Fdy. Co., prf.	118	.....
American Locomotive	69	—1⅜
American Locomotive, prfd.	101¾	—1
American Steel Foundries	61⅞	—1⅝
Baldwin Locomotive	113⅜	.....
Baldwin Locomotive, prfd.	108	.....
Bethlehem Steel	471	+1
Bethlehem Steel, prfd.	155	—5½
Colorado Fuel & Iron	50⅛	—1⅜
Continental Can	85½	—3½
Continental Can, prfd.	109½	— ½
Crucible Steel	72¼	—1¾
Crucible Steel, prfd.	110	+ ¾
General Electric	174¾	—1⅛
International Harv. of N. J.	110½	+2¼
Inter. Harv. of N. J., prfd.	118½	+ ½
International Harv. Corp.	84⅞	+12¾
Inter. Harv. Corp., prfd.	108	+2
Lackawanna Steel	81	—2¼
Nat'l Enamel. & Stmp. Co.	29	—1
Nat'l En. & Stmp. Co., prfd.	95	+2¼
Pressed Steel Car	63¼	—1
Pressed Steel Car, prfd.	103½	—1⅝
Pullman Palace Car	165	—2½
Republic Iron & Steel	54⅜	+1½
Republic Iron & Steel, prfd.	111	+1⅜
U. S. Cast Iron Pipe & Fdy.	25	— ¾
U. S. C. I. P. & Fdry., prfd.	51	—1
United States Steel	86	— ¼
United States Steel, prfd.	116½	+ ⅜
Westinghouse Mfg.	67⅝	—1¾

The Colt's Patent Fire Arms Mfg. Co., Hartford, Ct., declared a regular quarterly dividend of 2½ per cent and an extra dividend of 10 per cent, Dec. 9, payable Dec. 31. This jumps the annual interest rate from 18 per cent to 50 per cent. At the present market price of the stock, between 870 to 885, the annual interest would amount to about 6 per cent.

Harbison-Walker Report

The thirteenth annual report of the Harbison-Walker Refractories Co., Pittsburgh, shows a net surplus, after all charges, amounting to $922,889, for the fiscal year ended Sept. 30, 1915. This is equal to 5.12 per cent on the $18,000,000 common stock and compares with $548,988, or 3.05 per cent, on the same stock the previous year. President H. W. Croft has no comment to make other than that the increased profits over last year are due largely to the rapid revival of the steel business during the last half of the fiscal year. The company has had no interest charges to pay the last two years. The income account compares as follows:

	1915.	1914.
*Earnings	$1,673,790	$1,376,129
Sund. ded.	174,902	251,141
Net profit	$1,498,889	$1,124,988
Interest	.....	.....
Surplus	$1,498,889	$1,124,988
Prfd. div.	576,000	576,000
Surplus	$922,889	$548,988
Com. div.	360,000	360,000
Surplus	$562,889	$118,988
Prev. surp.	6,279,765	6,090,777
Total surp.	$6,842,653	$6,279,765

*After deducting $286,330 expenditures for all ordinary repairs and maintenance which covers depreciation of plants.

New Steel Casting Company

Milwaukee, Dec. 14.—Leo G. Smith, former manager of the Prime Steel Co., Milwaukee, which went into bankruptcy several months ago, has organized the Electric Steel Casting Co. of Milwaukee, and will engage in the production of electric steel material at once. With him will be associated two former Prime Steel employes, namely, F. G. Wetter, purchasing agent, and C. F. Taylor, of the selling force. The officers of the new corporation will be president, Leo. G. Smith; vice president and general counsel, Chauncey W. Yockey; secretary and purchasing agent, F. G. Wetter; treasurer, C. F. Taylor. Mr. Smith will be general manager.

In an interview given to an *Iron Trade Review* representative today, Mr. Smith said:

"We are now arranging for the erection of a steel foundry of the most modern type, which will employ from 150 to 200 men at the start and in time will have a pay-roll of 500 men. A site for the new works will be selected within a few days and in the meantime we are busy on plans for the foundry. We intend to erect a fireproof building, 80 x 500 feet of reinforced concrete, brick and steel, and our initial capacity will be three tons. Contracts will be awarded before the end of the month for a 3-ton electric furnace. Among the other equipment will be a 5-ton electric traveling crane and two wall cranes. It is reasonably sure that we will start actual production before May 1."

Placed in Receiver's Hands

Terre Haute, Dec. 14.—The Inland Steel Castings Co., a $50,000 corporation engaged in the manufacture of steel castings, was placed in the hands of a receiver last week upon the petition of the Standard Wheel Co., which said it has an unpaid account for only $364.78. Warren Ijams was appointed receiver.

Officers of both companies authorized the statement that the suit is of a friendly nature and that the action was taken to protect the company from creditors who had been threatening it with legal procedure to collect bills. The steel company is said to be solvent, with an abundance of assets, but it is embarrassed for lack of cash to meet current bills.

Donner's Statement

Philadelphia, Dec. 13. — President Wm. H. Donner, of the Cambria Steel Co., has issued a statement in which he denies that any definite plans have been developed for the merging of that company with any other steel company. The newspapers have carried numerous articles during the past few weeks connecting the name of

the Cambria Steel Co. with various schemes of combinations with other steel companies.

"In view of the insistent inquiries as to the plans for Cambria Steel Co.", says Mr. Donner, "it seems that there are erroneous impressions existing that the management has determined upon some definite plans which it has failed to divulge. I wish to state that as soon as any definite plans have matured, the stockholders are entitled to and will receive full information".

Plan Approved

Stockholders of the Hupp Motor Co., Detroit, at a special meeting recently approved plans for refinancing the company, whereby all the assets and business will be transferred immediately to the Hupp Motor Car Corporation of Virginia. The control of stock remains the same and officers of the new corporation are the same as before, as follows: President, J. Walter Drake; vice president and secretary, Joseph R. Drake; and treasurer, Edwin Denby. The company already has purchased the American Gear & Mfg. Co., Jackson, Mich., and plans are under way for an addition to both the Detroit and Jackson plants. The new issue of $1,500,000 preferred stock has been sold to three banking houses.

Financial Notes

New Era Engineering Co., Joliet, Ill., has increased its capital stock from $30,000 to $200,000.

Hahn Machine & Specialty Co., Detroit, has increased its capital stock from $5,000 to $10,000.

Snyder Electric Furnace Co., Monadnock building, Chicago, has increased its capital stock from $50,000 to $100,000.

The Consolidated Car Co., Detroit, automobile manufacturer, has increased its capital stock from $200,000 to $500,000.

Stockholders of the Thomas Iron Co. will hold another special meeting Dec. 30, at Hokendauqua, Pa., for the purpose of authorizing the company's officers to effect sale of the property in case the option obtained recently by N. L. C. Kachelmacher is exercised. At a meeting held Oct. 27 the stockholders gave a four months' option to Mr. Kachelmacher, who is said to represent the real prospective purchasers. The option was given at $55 a share, which amount was bid after William R. Taylor, of Philadelphia, successfully led a movement to have the stockholders refuse to accept a first offer of $45.

Heavy Ore Sales

Made by Eastern Companies—Rails for France

New York, Dec. 15. (By wire.)—Approximately 1,000,000 tons of eastern ores have been sold to eastern furnaces for 1916 delivery, most of which was done in the past week. Port Henry has been a heavy seller at 8¼ to 9 cents per unit, delivered, depending on grade and destination and at $4 per gross ton at mine for lump. This represents a general advance of 75 cents. Approximately 200,000 tons of local Jersey and New York state ores sold at 8½ to 8¾ cents. This is also an advance of 75 cents.

It is learned that negotiations for the merger of the Empire, Thomas Iron Co. and the Wharton Steel Co. are progressing favorably and early action is promised. It is understood that the promoters have the erection of a steel works in mind, probably at Wharton.

The Pennsylvania Steel Co. will furnish a large part of the 100,000 tons of rails asked for by the French government. The amount is estimated at from 50,000 to 65,000 tons. Other rail sales are 10,000 tons for the Southern to the Maryland Steel Co.; 5,000 tons for the Great Northern, to the Illinois Steel Co.; 4,000 tons for the Reading and 2,000 tons for the Buffalo, Rochester & Pittsburgh to the Carnegie Steel Co., and 4,500 tons for the Interborough Rapid Transit Co. to the Buffalo & Lackawanna Co. The Frisco rail order is not yet closed.

The Steel Corporation has announced that it will offer for subscription to its employes 35,000 shares of common stock, the price to be fixed later. The Corporation last year did not offer any stock to its employes on account of general financial and industrial conditions.

It is reported that the Pennsylvania railroad is trying to place 18,000 to 20,000 cars, but cannot get builders to accept its terms. France is inquiring for 5,000 cars.

The American Bridge Co will receive 4,000 tons for the Philadelphia subway.

The first steel made by the Minnesota Steel Co. was made on Monday.

Inquiries are pending for about 1,600 small presses for cartridge making, which it is difficult to supply.

Round tonnages of export orders for steel products have been refused by large makers at $8 to $10 above the domestic market.

New Boody House

Toledo, O., Dec. 14.—Sherman Bond, proprietor of the Boody House, states that within 30 days bids will be called for on the new $2,250,000 building which is to take the place of the present structure which was built away back in '71 and which has in its day entertained many persons prominent in the political life of the nation. The new building will have 16 floors and there will be 600 rooms. The building with furnishings, it is estimated, will cost fully $3,000,000. The new building will be started in the spring, which will give the old house just 45 years of service. Plans for the building are now being completed in the offices of Architects Mills, Rhines, Bellman & Nordhoff, 1234 Ohio building. While the details have not as yet all been figured out, it is estimated that the new structure will call for 4,000 tons of structural steel.

New President Elected

Several changes were made in the official personnel of the American Ship Building Co. at a meeting of directors held in Cleveland Dec. 9. Vice President M. E. Farr, of Detroit, was elected president, to succeed the late Edward Smith; O. J. Fish continues as secretary and treasurer, and also succeeds Mr. Farr as vice president; J. S. Gorman, Cleveland, was elected auditor. Four vacancies on the board of directors were filled. A. G. Smith, general manager of the American Ship Building Co., was elected a director, a position he had not held before.

Contract for Ovens

The Indiana Coke & Gas Co., Terre Haute, Ind., has placed a contract with the Gas Machinery Co., Cleveland, for 30 cross regenerative by-product coke ovens and by-product apparatus. The plant will be built at Terre Haute, Ind., and is to be ready for operation Aug. 15, 1916. Indiana coal will be coked in these ovens and for a time the coke will be manufactured for domestic use, the surplus gas to be sold to the Terre Haute Gas Co. for its local consumption.

Dwiggins Wire Fence Co., Anderson, Ind., has increased its capital stock from $75,000 to $150,000.

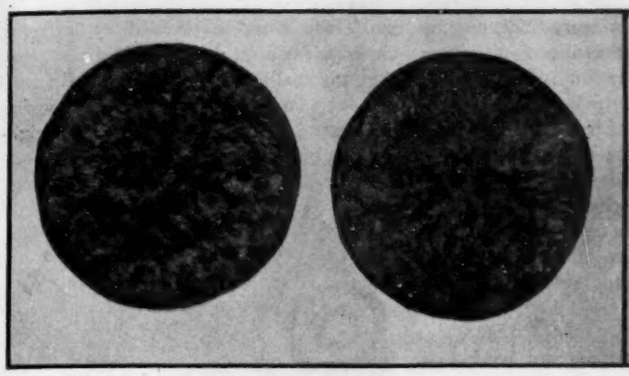


Fig. 1—Cast Iron Test Plug Showing Low-Mottled and Mottled Fractures

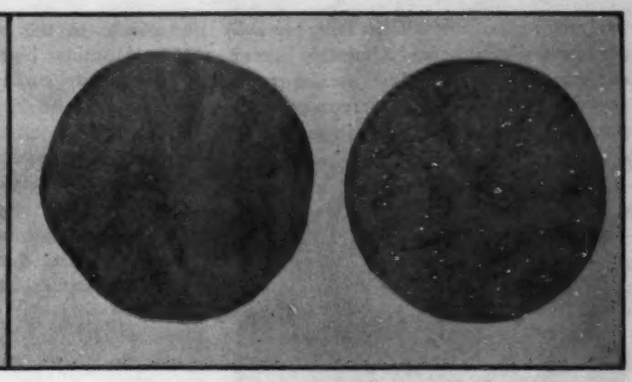


Fig. 2—Cast Iron Test Plug Showing White and High Mottled Fractures

The Control of Chill in Cast Iron

BELIEVING that the regulation of silicon was not a sufficient means of effecting the desired chill, and regarding variation in the total carbon as the principal cause of disturbance, Mr. Thrasher performed a series of interesting experiments in which the total carbon and silicon in each heat were determined, the resultant chill being carefully investigated. The author's conclusions are interestingly set forth in this article.

By Grafton M. Thrasher

SEVERAL years ago, while I was chief chemist of a malleable iron foundry, it occurred to me that the mere regulation of silicon was not sufficient to produce the desired degree of chill. But only after repeatedly encountering this fact in both open hearth and air furnace, as well as cupola metal, was I led to regard variation in the total carbon as the principal cause of disturbance; and I resolved to determine the total carbon as well as the silicon in every heat, and by a carefully prepared test piece to gage the approximate degree of chill. The test piece selected was a round plug, 2 inches in diameter and 12 inches long, cast on end in green sand. It was allowed to cool at least two hours in the mold before being cooled in water and broken in the middle; and the fractures were designated as gray, low mottled, mottled, high mottled, and white. All these fractures except the well-known gray one, are illustrated in Figs. 1 and 2. From the same ladle of iron from which the test piece was poured a shot sample was taken for analysis so as to represent the actual iron in the bar as near as possible; and the test in all cases was poured from iron taken from the furnace when about half emptied.

The author of this paper, which is to be presented at the February, 1916, meeting of the American Institute of Mining Engineers, is chief chemist and metallurgist of the Haskell & Barker Car Co., Michigan City, Ind.

Variations Plotted

It may be well to mention here that the principal disturbing influence on these tests is the fact (proved by experiment) that it is entirely possible to pour a mottled test and a gray test from the same ladle of iron, depending upon the pouring temperature of the iron. In order to study the cause of the variations more systematically a chart was prepared for plotting the analyses with carbon as ordinates and silicon as abscissæ.

It soon became quite apparent that the analyses corresponding to the test piece with average chill, designated as *mottled*, were arranged along a diagonal line on the chart with analyses corresponding to high and low chill at a more or less definite distance on either side of the line. It happened that about that time a heat had to be held pretty long in the furnace on account of a breakdown, and it became necessary to doctor it up with 50 per cent ferro-silicon to get the metal into pouring condition. The test piece from this heat was found to be just normal or what is designated above as *mottled*, and the corresponding

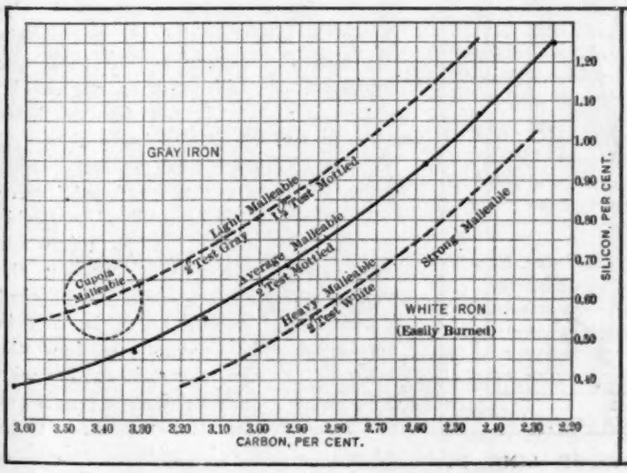


FIG. 3—LINES OF EQUAL NATURAL CHILL

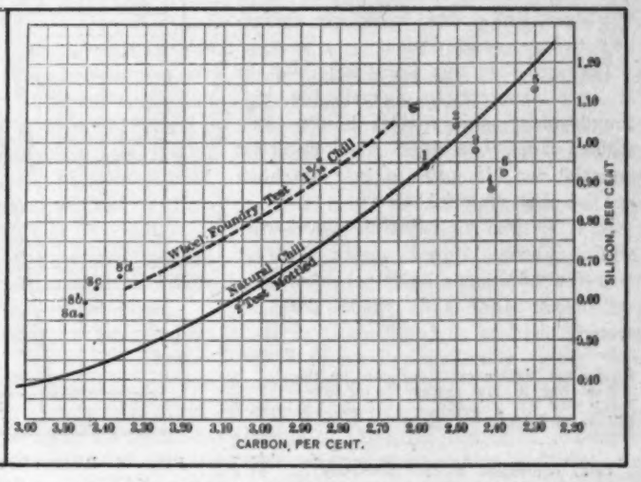


FIG. 4—ANALYSES OF BARS TESTED FOR TENSILE STRENGTH

analysis was silicon 1.07 and carbon 2.47 per cent, which served admirably for one extreme of the chill line as drawn on the chart. Something to represent the other extreme was found in a pig of

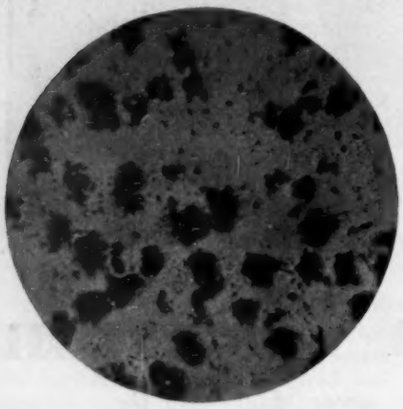


FIG. 5—STRUCTURE OF BAR NO. 1
Magnified 50 diameters

charcoal iron of the same dimensions as the test piece and having the proper degree of chill.

More recently I have obtained data for a new high-silicon point in which the analysis was, silicon 1.25, carbon 2.25 per cent. The chart as finally constructed is shown in Fig. 3.

As the manganese in all of these heats ranged between 0.25 and 0.35 per cent, which is normal for air-furnace malleable, and as sulphur averaged about 0.06 per cent, it will be seen that these elements interfered but little with the results. The phosphorus, of course, was between 0.13 and 0.18 per cent, and likewise had very little influence.

In examining the chart it will be noted that while the line tends to curve somewhat, yet it is sufficiently straight through the usual range of analyses to permit the assumption for practical purposes that four points of carbon are equivalent to three points of silicon in the regulation of chill, when the silicon is above 0.70 per cent; and that below this about two points carbon are equivalent to one point silicon.

The value of this knowledge will be at once apparent to a malleable iron foundryman, as it enables him to substitute large quantities of low-carbon material for his sprue in case of shortage of that material, thus:

It is desired to substitute steel containing silicon 0.10 and carbon 0.30 per cent for 1,000 pounds of sprue containing silicon 0.80 and carbon 2.80 per cent.

	Pounds.
Equivalent deficiency of silicon in the steel due to low carbon = (2.80 — 0.30) × ¾ × 1,000 =	18.7
Silicon deficiency = (0.80 — 0.10 × 1,000 =	7.0
Total equivalent silicon deficiency...	25.7

Therefore, it is necessary to increase the silicon in the mixture 25.7 pounds by substituting higher-silicon pig iron. The popular conception of malleable iron accepts the limits of 0.60 to 0.90 per cent in silicon, with a very indefinite notion as to what the carbon content in the hard state should be; but a careful examination of this chart will show that for a given silicon percentage there is a definite carbon percentage, which is proper for each class of castings.

Attainment of Malleability

In order to prevent cracked work and for other economic reasons, the malleable iron foundryman runs his mixture as nearly gray as he dares, but if he desires to produce a very strong iron the presence of primary graphite in the hard iron must be avoided by lowering either the silicon or the carbon or both. As to malleable iron produced with the same average chill but with varying analyses, it will be found that the high-

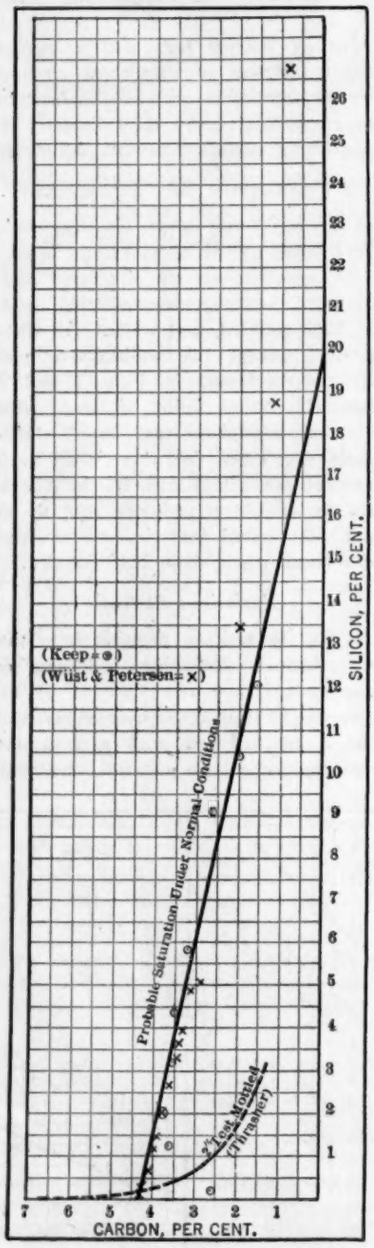


FIG. 6—RELATION OF LINE OF NATURAL CHILL TO THAT OF SATURATION

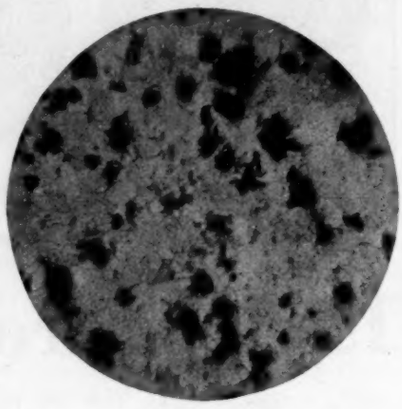


FIG. 7—STRUCTURE OF BAR NO. 4
Magnified 50 diameters

silicon, low-carbon mixture is more sound and reliable, but possibly a little less fluid, while the high-carbon, low-silicon mixture is subject to greater shrinkage and segregation, which produce weakness.

The principal consideration for the foundryman is to produce that type of structure which is necessary to obtain malleability upon annealing; and the chart shows the proper adjustment of silicon and carbon to bring about this desired result for the different grades of work.

It will be further noted that, of the three factors considered, namely, silicon and carbon content, and chill, if any two be known the other may be predicted approximately.

Malleable iron produced from the cupola is pretty well confined to the dotted circle shown on the chart. Its proximity to gray iron, as well as its position in the field of greater shrinkage, will account for its weakness, which is not due as popularly supposed to the higher sulphur content. As the carbon is automatically adjusted within this range by melting in the cupola, the regulation of chill must be effected by silicon alone. It is not feasible, however, to run a mixture lower than 0.50 per cent silicon because the cutting action of the slag thus produced is very hard in cupola linings. Good malleable castings are produced along the whole length of the charted lines; but the average foundryman, with his limited knowledge of conditions to be met in another foundry, cannot see how the other party makes a certain casting with 0.90 silicon while he finds it necessary to make it with 0.60 silicon. It is hoped that the publication of this chart will clarify the matter. The lines here given have been confirmed by plotting

hundreds of analyses of mixtures of known chill and normal pouring temperature and the chart has been found a valuable aid in practical work.

Regarding the strength of malleable iron produced from irons of varying degree of chill, the following data, charted in Fig. 4, from test bars poured every other day for two weeks, will give a good idea of the effect of this factor:

Bar No.	Tensile strength, lbs. per sq. in.	Elongation, per cent.	Silicon, per cent.	Carbon, per cent.
1	43,680	10.0	0.94	2.58
2	44,770	9.5	1.04	2.50
3	48,340	10.5	0.98	2.45
4	49,710	13.0	0.88	2.41
5	49,440	12.0	1.03	2.30
6	48,080	11.0	0.92	2.38

These test bars were round, 0.8 inch in diameter for 2 inches in the middle, and enlarged at the ends for gripping. A shrink ball was cast on one end to insure soundness. The structure of two of these bars is shown in Figs. 5 and 7. No. 1 the weaker bar, shows slight inclination to graphitic structure in the shape of the carbon particles.

The nearest approach that I have noticed to the co-ordination of such valuable facts as are above outlined is the paper published in the *Proceedings of the American Foundrymen's Association,* a couple of years ago, by John Jermain Porter, in which he plotted silicon and combined carbon; but as he made no statement as to the size of the castings from which these results were obtained, it is probable that this factor was not kept constant, which of course would account for a great many irregularities. Also, no reference was made to the effect of the total carbon on the combined-carbon content, which is highly important.

For the purpose of comparing the *natural chill* with that produced when cast iron is poured against an iron chiller, a test was made which conformed to that used in a car wheel foundry, using the same pattern and chill box. A ladle of very hot low-carbon iron was treated with sufficient 50 per cent ferro-silicon, as calculated from the chart, to produce the same degree of chill as that of the iron used in car wheels. It was necessary to allow the metal to cool for several minutes in the ladle before pouring, in order that the temperature should approximate that of practice in the wheel foundry, where the metal is not so hot when melted. The result of this experiment is chartered in Fig. 4 as No. 7, while a regular test piece from a wheel mixture showing the same degree of chill (1 8/16 inches) is charted as No. 8. The significance of this experiment is that it points the way to the production of car wheels with high silicon, low carbon, and low sulphur by the use of an open hearth furnace for melting. The rapidly increasing sulphur in the cast iron car wheel of today, due to the remelting of old wheels, is a source of anxiety to both the manufacturer and the railroad. The percentage of cementite in the structure of such a metal would still be sufficient to insure good wearing qualities and a higher percentage of silicon would insure soundness. The absence of large quantities of manganese sulphide, which is undoubtedly the cause of a large percentage of the defects in the tread, would be a strong argument in favor of such a metal.

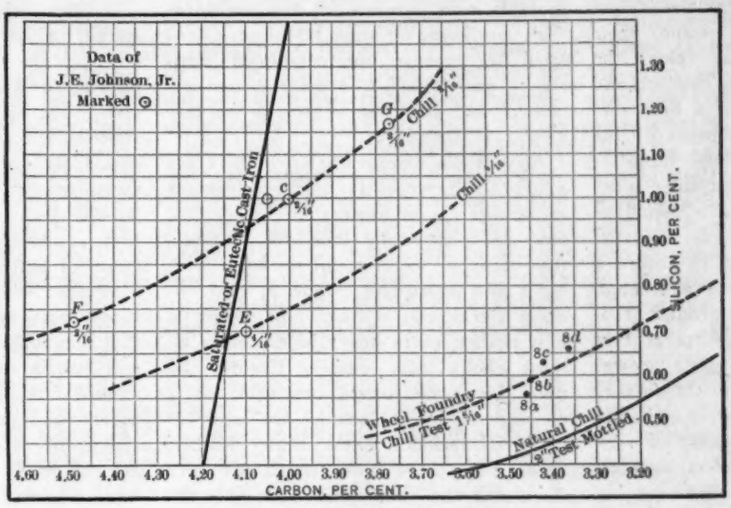


FIG. 8—DATA OF J. E. JOHNSON JR.

It may be profitable to consider here the relationship of the *lines of natural chill* as described to the line of saturation of silicon and carbon in cast irons. For this purpose I have prepared another chart, Fig. 6, which outlines this relationship. The saturation figures are taken from Keep's *Cast Iron,* p. 45, and from the work of Wust and Petersen, as outlined by Hatfield. The line I produced, which is that of *natural chill,* is the same as that marked *2 Test Mottled* in Fig. 3. As a speculation it has been extended toward 6.67 carbon, as its probable trend in that direction, and upward to 3.50 silicon and 1.25 carbon, where it most probably tapers off and disappears due to the absence of carbon in sufficient excess of the pearlitic ratio to form graphite, which is necessary to produce the mottled fracture described.

It may be well to add a word concerning the influence of the other elements necessarily present in commercial irons which have been disregarded in this paper.

The effects of manganese and sulphur must be considered together, since it has been shown by several eminent investigators, that where present together in the proper ratio, they exist as MnS which, properly distributed, would be neutral and ineffective upon the chill or strength of the metal. In practical work it is found necessary to carry an excess of manganese above this ratio, to insure reliable metal. In cupola-melted irons where the carbon is high, an excess of from 0.05 to 0.10 per cent of manganese is sufficient, while iron melted in the air furnace or open-hearth requires from 0.10 to 0.30 per cent excess on account of greater exposure to oxidizing influences. It will be seen that where iron is properly melted to a fluid condition, the sulphur is fixed and without influence on chill, etc. If the 0.30 per cent excess manganese is figured to Mn_3C it will be apparent that it can affect only 0.02 per cent of carbon, which would have but small influence on the chill.

In my opinion the effect of sulphur on the chill, even when present uncombined with manganese, has been greatly exaggerated, and oxygen occurring simultaneously will be found responsible for this exaggeration. Regarding the effect of phosphorus on the chill, it will be sufficient to cite Hatfield, who says, in discussing Stead's work on this element:

"Since, however, there is seldom more than 1.5 per cent of phosphorus present in pig irons used in foundry work, it may be considered that the influence of such percentages upon the condition of the carbon is negligible".

It will be seen that in the control of chill in malleable iron and car-wheel mixtures, where this element does not exceed one-fifth of 1.5 per cent its effect cannot be noticed.

Though I have not made an independent investigation of the effect of oxygen on the chill, I am inclined to believe from the data at hand that its effect is mainly qualitative rather than quantitative. While I fail to agree with some of the conclusions of J. E. Johnson Jr., I think his theory of the existence of an oxy-sulphide is true. In

(*Continued on page* 1208b).

How Your Leather Belting is Made

IN THIS article the manufacture of leather belting, suitable for modern shop conditions, is covered in detail. The author dwells on the importance of tanning the leather properly, using first-class hides and tanning extracts of uniform quality. The difficulties of purchasing belting solely according to specifications are pointed out and the necessity of carefully fitting the belt to the drive is emphasized by the author.

By F. H. Small

THE manufacture of leather belting has its beginnings on the farms of New England, the grazing ranges of the Argentine, the rocky Alpine pastures of Switzerland, the fertile plains of France—wherever cattle are raised. The cattle supply the hides which are one of the essential raw materials of the tanner and so of the belt maker. It is essential that the cattle industry should prosper if leather is to remain as universally usable a commodity as heretofore. Cattle are raised primarily for their labor value, their milk value and their meat value; the hide is very much of a by-product and the matter of production of a hide specially suited to the requirements of the tanner is but an infinitesimal incentive to the cattle grower. When steer hides sell at better than 26 cents a pound as they have this year, when as much as $40 per hide must be paid to secure a particular selection, it seems as though the hide, even if but a by-product, represents a sufficiently large percentage value to secure from the cattle grower an endeavor to produce a satisfactory hide. The tanner, however, has had a hard time to establish this point of view although, aided by governmental agencies whose interests have been different but objective similar, progress has been made.

The particular evils of which the tanner has complained and for which the cattle raiser is responsible are three: Barbed wire, brands and grubs. Barbed wire fences lead to scratches on the hair or grain side of the hide, which though they later heal yet constitute imperfections; branding destroys the hide fibre and makes so much of the hide as is touched by the branding iron absolutely worthless for purposes of belting manufacture; grubs are worst of all, for the reason that they do their damage in the very best part of the hide and oftentimes are so numerous that a hide affected by them gives the appearance of having been used as a target for a shot gun.

The first two evils are subject to individual correction; the last can be remedied only by concerted and wide-spread action. It is a question for governmental investigation and legislation. The investigation has been and is going on, but the efficient remedy is not yet, though progress is making. In one district in Denmark, for instance, where they can be reasonably autocratic, by making the presence of warbled cattle in herd punishable by fine, they reduced in six years' time the percentage of warbled cattle from 18 to 1. The above is mentioned for two reasons: First, to bespeak your interest in any measures that may come to your attention, calculated to improve the conditions mentioned, and second, to show you how uncontrollably imperfect is one of the tanners' raw materials.

Apart from damages as cited there are material differences in hides—differences in texture, in plumpness, in uniformity, etc. It is generally true, for instance, that cattle in warm countries have thick hides and short hair, while in cold climates the reverse is true. Our supply of first quality, extra heavy hides comes almost wholly from southern Europe, and these being no longer obtainable as a consequence of the war we are hard put to it to produce extra heavy leather. Some cattle have hides which are very thick over the kidneys and thin over the shoulders; others show this difference much less markedly.

When the hide is removed, the way in which it is done is again a matter of keen interest to the tanner. Cuts in the hide made by the butcher when taking it off the animal lessen the value very materially. The *take-off* of hides from the large packing houses is usually excellent, the result of specific attention, carefully trained and expert labor. It is quite otherwise with the average country hides taken off by the town butcher, which despite the efforts of the Tanners Associations, are still a source of shame. The flaying is so bad that they rarely bring the price of a packer hide and they represent a real and needless economic waste. Abroad, methods of so-called mechanical flaying have been introduced to avoid butcher cuts. By these methods the hide is pulled and hammered from the carcass and such hides usually command a premium, 50 cents a hide being an average figure paid at the Paris auctions of cattle hides. What happens to the hide after its removal from the animal and before the tanner gets it, is again of importance. Hide, being essentially gelatine, readily spoils and must be preserved against decomposition. Two methods of preserving or curing hides are in vogue, viz.: Drying and salting. The first is ordinarily too uncertain to permit of the use of hides cured in this way for belting and practically all hides tanned for belting are what are known as green-salted hides.

If the belt manufacturer tans the leather which he makes into belting—and this is the ideal arrangement—he buys so far as possible green-salted hides, free from scratches, brands and grubs, short-haired, of as uniform thickness as obtainable and which have been skilfully taken off, so that they are free from butcher cuts; i. e., the manufacture of first quality belting begins with the purchase of first quality hides.

Before being used for belting these hides must be tanned, i. e., so treated that they will not decompose or spoil and will remain flexible. There are various methods of tanning hides but whatever the method used, the first steps, usually spoken of as the beam house treatment, are essentially the same, namely: preliminary washing with water to remove dirt and the salt or other material which may have been used to cure the hide; a cleaning of the flesh side to remove superfluous flesh, fat, etc., left on in the flaying—a soaking in milk of lime, or some other depilatory solution, to loosen the hair, which is then pushed off by machine or with a dull two-handled knife; and a final washing to remove at least in part the unhairing chemical and to clean the hide. The quality of the finished leather depends in very large measure on the successful performance of these apparently simple operations. It is an old saying that leather is made in the beam house.

The conversion of the hide as above prepared into leather may be brought about through the use of any one of a variety of tanning materials, the peculiar characteristics of the finished leather being governed by the material used. Only a few of these materials will be mentioned and such only as have a special interest to the belt manufacturer. One of the simplest and oldest methods of tanning is to cover the raw hide in

Presented at the meeting of the Providence Association of Mechanical Engineers, affiliated with The American Society of Mechanical Engineers, Sept. 22, 1915. The author, F. H. Small, is chemist of the Graton & Knight Mfg. Co., Worcester, Mass.

the moist condition with grease and then continually manipulate it as it dries, thus working the grease into the inmost fibres of the hide and producing a grease-tanned leather. Grease-tanned leather has little more fullness or body than the original hide, but it is exceptionally strong. The so-called mechanical lace used for lacing together belting is tanned in this way.

Another method of tanning which has come down to us from olden times is to work into the hide a mixture of alum and salt. This gives a somewhat fuller leather than grease and is used before the grease treatment by some tanners of mechanical lace because of the fullness gained, but it is at the expense of the toughness and wearing qualities of the lace.

A modern tannage of somewhat similar nature is that with salts of chromium, the hide being immersed in a solution of one of these salts. Chrome tanned leather is fuller than alum tanned and much more permanent. Water will seriously injure alum - tanned leather, causing it to revert nearly to the condition of raw hide and to become hard and cracky, whereas water has little or no effect on chrome leather. Chrome leather may even be immersed in boiling water for some little time without serious damage to the leather. Most of the so-called steam-proof belting is made from chrome-tanned leather.

How Belting is Tanned.

By far the greatest percentage of heavy leather, and in particular that used for belting, is tanned with a tannin derived from some vegetable material. The procedure of the tannin process as early practiced with vegetable materials was to spread the hides out flat in a vat with a relatively thick layer of the tanning material between the hides, the vat finally being filled with water. The water served as a medium of exchange, extracting the tannin from the vegetable material and giving it to the hide which, absorbing it, became tanned. The process was slow, often necessitating a year or two to effect the conversion of the hide into leather.

An improvement in the process was effected by substituting for the water a tan liquor obtained by leaching the tanning material in large tubs; i. e., extracting the soluble tannin by passing hot water through the ground raw material. Nowadays the use of the raw tanning material by the tanner is almost a thing of the past. He uses instead tanning extract prepared at plants usually located where the supply of raw material is abundant and which is a concentrated solution of tannin obtained by leaching the raw material with water as was formerly done at the tannery, and then evaporating away much of the water in a partial vacuum at low temperature and yielding as the commercial product ordinarily a thick brown liquid containing about 25 per cent actual tannin. Not merely does this supply the tanner with his tanning material in a form much more convenient for use, but it has the further decided advantage that the extract admits much more easily of analytical control and so makes possible the use of a determinate and uniform tanning agent. Since uniform product demands uniform raw material this is an improvement of no mean order.

Not so long ago—in fact as recently as 1890—practically all the vegetable tanned heavy leather in this country was made with either hemlock or oak bark, or a mixture of the two. Now, while the old names, hemlock, oak and union, are still retained, it would be hard to find a tanner making leather with these materials alone. The present-day tanner uses not merely hemlock and oak, but chestnut wood, or valonia, or myrobalans, or mimosa, or quebracho, or wattle, or mallet, or algarobilla, etc., some twenty-five or thirty materials being commercially available.

With an increased range of materials came, of necessity, a study of the leather-making qualities of each. Marked differences appeared. For instance, the tannin of valonia was found to decompose rather rapidly, forming and depositing insoluble ellagic acid. The English tanner, earlier to use these materials, had discovered this by experience, and by using valonia and insuring the deposition of the ellagic acid in his leather, was making the solid English sole waterproof and long-wearing, which earned him a reputation the world over. A myrobalans liquor was found to sour very rapidly, yielding eight times as much acid, for instance, as mimosa under the same conditions.

The leather-forming value of the materials varied; valonia would produce over 100 pounds of finished leather as against 75 for myrobalans, from the same weight of hide. Chestnut wood produced a leather of tensile strength over 3,000 pounds to the square inch, while oak bark under similar conditions gave one of less than two. Here certainly was knowledge and opportunity the tanner could not neglect. Knowing what qualities he desired in his finished product, he could, by a careful selection of tanning materials, go far toward securing these qualities, this material making for fullness, that for strength, etc. The progressive tanner, who wanted to make the best belting leather, could not afford to make oak belting with oak bark alone, and he did not, and his leather is the better in consequence.

The objection to practically all the tannages, aside from that with vegetable tannin, is that they do not make a plump, full, solid leather. The leather produced by them is tough, but thin and open. The original hide constitutes much the largest percentage of the finished product, only a small quantity of the tanning material remaining in the leather. This is in marked contrast to the vegetable tannage in which so much tannin and other matters is deposited in and on the fibres of the hide that the original hide constitutes less than 50 per cent of the final leather.

Lack of firmness is a serious deficiency in a leather to be used for belting. Nevertheless, leathers made with some of the above materials have sufficiently valuable properties so that they have made considerable headway for belting even despite their failings. Chrome leather, for instance, can be produced in a comparatively short time. It will run practically unharmed in a temperature where vegetable tanned leather would revert to a brittle, formless mass. It can be made exceptionally flexible. It has a high coefficient of friction. Consequently belting from chrome leather has found a place for itself, which would be larger, were it not for the deficiencies resultant from the lightness of the tannage, the lack of solidity of the leather and the necessarily high cost because of the small leather-yield. A leather tanned with a combination of alum and gambier, the gambier being used to supply the deficiencies of the alum as a filling material, has likewise had some vogue. It is tough and pliable, and has given good service for high speed work.

A late development in the way of a new tannage is that originated and used by the Graton & Knight Mfg. Co. in the production of a certain grade of leather. This leather is a full, reasonably firm and solid leather, resembling in this respect the vegetable-tanned leathers, and very flexible. It has a higher coefficient of friction than chrome and consequently a better pulley grip and it will be remembered chrome is superior to oak in this respect. It is resistant to heat and other harmful agencies.

What is a Good Belt?

It was stated above, that if the belt maker knew what qualities he wanted in the leather from which he made his belting, he could go far toward obtaining these by proper choice and application of tanning material. To enumerate these qualities as our experience has shown them:

First.—We need good driving surface, sufficient friction between belt and pulley to eliminate slippage as completely as may be and to enable the belt to carry its load under minimum tension, thus avoiding useless waste of power at the bearings;

Second — Lateral stiffness coupled with pliability, the stiffness to keep the

belt from twisting and waving and to prevent its curling at the edges when shifted; the pliability to enable it to hug the pulley, wrapping itself round and so securing large arc of contact, and to enable it to alter its shape with the minimum of internal resistance as it travels round the pulley;

Third.—Good tensile strength that it may carry its load without breaking;

Fourth.—Little stretch but considerable elasticity; the former so that it will need to be shortened as seldom as may be, i. e., will do its work uninterruptedly; the latter so that it may easily take up and let go its load as it travels round the pulley;

Fifth.—Firmness or stability, much the same as lateral stiffness, so that the leather springs little when cut, holds its shape, remains straight and runs true on the pulleys;

Sixth.—Resistance to external conditions, such as heat, moisture, chemicals, etc.; that it may do its work in any place, at any time, and enduringly;

Seventh.—Low initial cost.

It is apparent that no leather can have all these qualities in the highest degree, for some of them are incompatible. Sole leather would do admirably as far as lateral stiffness, little stretch, and firmness are concerned, but would fail lamentably to satisfy the requirements of pliability, tensile strength, elasticity, etc. The best result we can achieve is bound to be somewhat of a compromise. We must aim to get the largest measure possible of the most desirable qualities in our leather, with the least necessary sacrifice of others. There is where the belt-maker who tans his own leather has a marked advantage in that he may bend all his efforts to so adjusting his tannage as to secure the best possible compromise. Quality belting demands then,—first, suitable hides, — second, suitable tannage.

We now have the leather and may proceed to prepare it for making into belting. Of the hides which we have tanned only 50 per cent may legitimately be cut up into belting and less than 40 per cent will go into first quality belting. First, we reject the bellies, cropping or cutting them off at the flank; this loses us 25 per cent of the hide. Next we cut off the shoulder at a point 4 feet 4 inches from the tail or, if the hide be exceptionally small, at a less distance; this loses us 25 per cent more, leaving us for cutting into belting a "bend" which constitutes less than 50 per cent of the original hide.

This bend has now to be curried, i. e., given a supplementary grease-tannage; set out—to give a smooth flat piece of leather—and then stretched. The stretching is done on frames in which the wet leather may be clamped and subjected to as much tension as desired, the leather being allowed to dry under tension on the frames so that an additional stretch resultant upon the natural shrinkage of the leather in drying is imparted to the leather. Before being stretched the bend is usually cut into a center and two side pieces, inasmuch as the center portion being more close fibred will not stretch as much as the side pieces and by being divided as above the leather can be stretched more in accordance with its capacity. After stretching the leather is rolled and glassed to improve its looks and is then ready to go to the stock room.

When the leather is received in the stock room, it is sorted according to weight or thickness—which in this connection are practically synonymous terms—into extra heavy, heavy, medium and light, and then packed down for future use. The sides are packed in square piles with alternate layers at right angles, to keep the stock flat and straight and allow of a circulation of air through the pile, thus aiding and hastening the seasoning process. This seasoning is an often neglected but most desirable operation, for the use of well seasoned leather is as important in the manufacture of belting as the use of well-seasoned lumber is in building. Belts made from well-seasoned stock stretch less and more uniformly, retain their elasticity and wear longer than belts from green stock.

Deceptive Specifications

From the stock room the leather goes to the belt shop where its manfacture into belt takes place. The first step in this process is to straighten one edge of the leather. Next it is cut into strips of various widths by passing between a rapidly revolving circular knife and a guide, the strips being graded for width and roughly for quality as they come from the knife, and then stored in racks. From these racks the leather goes to the sorters, by whom it is most carefully graded, both for thickness and quality, and on their expertness depends the maintenance of the standard set for each brand of belt. Accurate judgment of quality depends on wide experience in handling leather and a good all-round knowledge of the specific characteristics of the leather in different parts of the hide, for it is a fact that no two square inches of hide are precisely alike.

Quality, however, is very elusive of definition when one tries to imprison it in the confines of a specification and the buyer is fully as likely to be well served if he states his needs and trusts to the honesty of an established and reputable house as if he attempts to be his own judge. The author has in mind a large railroad buying belting according to a specification which called for the leather to be cut from strictly first quality belting butts and they were getting it, *necks* and all. Inasmuch as a belt is no better than the poorest strip in it, similar to the chain that is no stronger than its weakest link, it may be imagined how well they were being served. Later when another belting company had an opportunity to supply this railroad with some belting it was rather chagrined to have it rejected by the railroad inspector. Some rolls of stock belt of a grade distinctly inferior to that first offered were then submitted and accepted by the inspector with a cheerful response: "That's what we want; why didn't you give us that at first?'

Returning to the process of manufacture, after the strips have been sorted, they then go to the *fitters* to be matched and have the laps marked. Pieces cut from the right side of the hide are matched with pieces cut from the left side, because all strips which are not backbone center pieces will stretch in a curve if subjected to a sufficient strain. Narrow strips from a properly stretched side, merely as a result of the stripping, contract to a slight curve. Belts made by joining alternately rights and lefts will roll out in a curve on the floor but will run true upon the pulleys, while belts in the construction of which no attention is paid to the matching of rights and lefts will roll out straight on the floor but will invariably stretch crooked if subjected to sufficient tension on the pulleys. Not all belts show these characteristics noticeably because not all belts are required to transmit sufficient load to develop them early enough in the life of the belt for them to attract attention.

The laps are marked according to the thickness of the stock and usually range between 4 inches and 10 inches in length. Laps must be longer on the shoulder end of the piece because hides become thinner, taper off faster, near the shoulder than near the rump, and longer laps are needed therefore to maintain a uniform thickness of belt. Shoulder ends are joined to shoulder ends and butt to butt because the length of the laps match better, the thickness is more uniform, the stock is similar in quality and the component parts will therefore wear and stretch more uniformly. The laps are next scarfed and prepared for cementing.

The usual cement employed to stick the laps has for its basis animal glue. Each manufacturer is likely to have his own pet formula calling for certain additions to the glue solution and particular methods of compounding, but they all look much alike. By this it is not meant to disparage the cement, for a cement that will hold as long as the

leather will wear, is a necessary component of a quality belt. About twelve years ago saw the beginnings of the now indispensable waterproof cement. Laps stuck with this are absolutely unaffected by water, either cold or hot. Whatever cement is used the process of *sticking* is the same in its essentials. The surfaces of the leather to be joined are coated with the cement, put together in their final position, placed between the plates of an hydraulic press and subjected to heavy pressure. From the presses the belt goes to the inspector and then to stock.

The above description applies more particularly to single belting, but the processes are much the same if double or three-ply belting is to be made. A liberal quantity of stock which has been scarfed and the flesh side of which has been cleaned up with a scraper to remove grease, loose flesh, etc. (this being the side which is cemented) is placed upon the fitter's bench. He matches these together on a smooth surface against wooden blocks which are his standard of thickness, the pieces being matched to secure as uniform thickness as possible and so that the laps of one ply come about half way between the laps of the opposite ply.

How to Make Belts Last

In conclusion, I wish to emphasize the fact that the idea that a belt is only a belt and one need merely cut off a piece of the requisite length and put it on the pulleys is no longer tenable. Proper mechanical conditions and adaptation of belt to drive are just as essential to economy of operation as is the suiting of a motor to the work it has to do. As illustrating the first might be mentioned a three-pulley quarter-turn drive with fixed idler that came to our attention. This required an 11-inch belt and was called upon to transmit 100 horsepower. The best belt procurable lasted about two months on this drive. Changes in the plant demanded more power from the drive and it was altered to a five-pulley quarter-turn, which necessitated the use of nearly three times the former length of belt. A belt an inch wider is delivering double the horsepower and is good for at least ten years.

Returning to the railroad, their theory of operation was to keep rolls of belt in stock and cut off a length as it was needed. On one machine of which they had record, the average life of a belt was six weeks. Our belt man succeeded in securing the installation of a belt suited to the drive and at last accounts this belt had been in operation over six months and was apparently then in perfect condition.

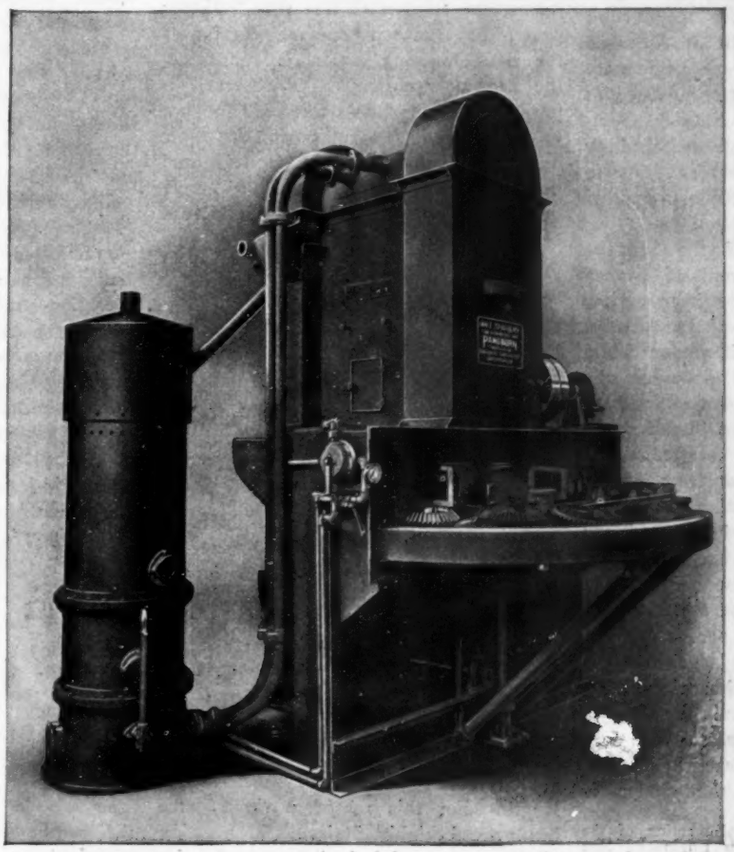
Another illustration of suiting the belt to the drive: A customer complained that an 18-inch edger belt furnished him was not working satisfactorily and one of our belt men investigating the conditions, found that at the high speed at which the belt traveled, the load was not sufficient to keep the belt

(*Continued on Page* 1208b)

Designs a New Rotary Table Sand Blast

THE high pressure rotary table sand-blast shown in the accompanying illustration is a development of the Pangborn Corp., Hagerstown, Md. It is designed for handling medium and small castings. These machines are built in two sizes, having 90-inch and 70-inch diameter tables, respectively. The overall height of the large machine is 12 feet and of the small machine 9 feet 6 inches. Both sizes have the same clearance over the surface of the table.

These machines comprise a multiple chamber pressure sand-blast, complete rotary table with driving mechanism and housing, and a belt bucket elevator. The equipment is centrally controlled and operated from the front. The table makes one complete revolution in five minutes. The blasting compartment is completely enclosed by a series of rubber curtains, so that no sand or dust comes outside the housing. The rotating nozzles are set at a slight angle and pass over the entire surface of the table. Two nozzles are provided on the large and one on the small machine. All moving parts are enclosed. In operation, the workman places a layer of the pieces on the table as it rotates. The nozzles revolve inside the housing and cover the entire surface of the table. As the pieces come out from under the curtains they are turned over.



DIRECT HIGH PRESSURE ROTARY TABLE SAND BLAST

When thoroughly sand blasted, they are removed and new work is placed on the table. The sand, after striking the work, falls through the grates of the table to the boot of the elevator and is returned automatically to the sand blast. The refuse is thoroughly separated from the sand.

The multiple chamber sand blast refills without interrupting the blasting. The dust laden air is exhausted through the openings at the rear of the housing. The rotating of the table and the handling of the sand require approximately four horsepower. Sand, chilled iron grit, shot or any other abrasive can be used in the operation of this machine.

Rotary Roaster Kilns for Iron Ores

FOR THE AGGLOMERATION of fine ores where loss in the dust catcher is excessive, for the desulphurization of lump and fine ores, or for a combination of the two processes, rotary kilns have assumed no small economic importance of late years. Their chief value is in the treatment of pyrites cinder. Mechanical difficulties have now been practically eliminated. Mr. Doak describes the modern rotary kiln.

By Samuel E. Doak

THE utilization of rotary kilns of the cement type, for the preparation of iron ores for the blast furnace, has become of considerable economic importance within the past decade in certain localities, such as those where the native ores are lean. Such kilns may be used simply for the agglomeration of fine ores whose loss in the dust catchers is excessive, and whose fineness is detrimental to the working of the furnace, or for the desulphurization of lump and fine ores, the sulphur content of which does not exceed 6 or 7 per cent. The desulphurizing action can be combined with that of agglomeration, provided the kiln is sufficiently large. The kiln, if properly designed for the character of ore to be treated, will compare favorably in its results, both as to economy and quality of product, with other processes. It is not, however, as well adapted for the treatment of flue dust as is a sintering operation, on account of the large percentage of fine coke contained therein. Any combustible entering the kiln at its feed end renders the process very much more expensive and unsatisfactory on account of the difficulty of controlling the temperature, also because of the rapidity with which long "rings" form, due to the increased heat at the cooler end of the kiln.

The greatest value of the kiln at present is in the treatment of pyrites cinder; that is, the residue from pyrites ore after the extraction of the greater part of the sulphur. This cinder, while high in iron content, has too much sulphur remaining in it to be allowed to form a large part of the blast-furnace burden, without further treatment. It will range in metallic iron from 42 per cent, representing a very low-grade cinder from a domestic pyrites, to 64 per cent of the residue from the best Spanish ore, and the corresponding silica content will vary from the maximum of about 25 per cent to 1½ per cent. The residual sulphur depends largely on the type of burner used in the original desulphurization. In general, the leanest original ores retain the greatest amounts of sulphur. In modern practice the proportion of sulphur in the cinder is rarely as great as 6 per cent, and seldom lower than 1½ per cent. Average analyses for iron, silica, and sulphur of the cinders which have come under personal observation are as follows:

	Iron, per cent	Silica, per cent	Sulphur, per cent
Virginia fines	48	18	4.2
Virginia lump	54	12	5.0
Spanish fines	58	8	2.5
Spanish lump	63	2	2.0

In addition, nearly all cinders contain zinc, copper (frequently in sufficient amounts to be extracted commercially as a by-product), calcium, magnesium, etc., and sometimes lead. The total of these accompanying elements, however, is usually well under 6 per cent. The process is a simple roasting, with the addition in the case of fine ores of a nodulizing or agglomerating operation, which is performed near the discharge end of the kiln, at a higher temperature than is necessary for the desulphurization, and if the kiln is not forced over its capacity there is no difficulty in reducing the sulphur to less than 0.05 per cent of the finished product. As far as the desulphurizing action is concerned, the principal caution to be observed is not to allow the kiln to become too hot at its rear end. To get a dead roast the operation should be very gradual, and the heat should range from a barely perceptible dull red at the feed end to a bright yellow at the discharge end. When the ore is too hot in the center of the kiln, there seems to be a tendency to hinder the desulphurization, probably on account of an almost imperceptible glazing of the particles of cinder, which renders them impervious. For this reason it is important that the roasting should be complete before the nodulizing begins, since for the success of the latter operation the ore should be sufficiently pasty to ball up. This pastiness, however, should never be carried to the point where there is any flow of the cinder, and in fact it should never be visible in the kiln. A bright yellow heat is sufficient for the nodulizing, and it is well to keep the zone of agglomeration as near the discharge end of the kiln as possible, 15 feet being sufficient length for the operation in any kiln not more than 100 feet in length. For this reason a short flame has proved highly desirable in practice. The oxygen which is necessary for the desulphurization is furnished either by stack draft at the feed end, by a blower at the discharge end, in connection with the fuel supply, or by both. The height of the stack is determined more by the necessity of raising the sulphur fumes above the height where they are obnoxious and harmful, than by the oxygen requirements of the process, as the slope of the kiln, together with the draft induced by the coal blower is sufficient in small kilns to furnish the required amount of air without a stack. A kiln 60 x 5 feet was run for several months without any stack, with excellent results, the only artificial draft being supplied with the powdered coal by a pulverizer. This same kiln on an 80 x 4-foot stack gave incomplete desulphurization and an excessive amount of ring trouble, due to too high a temperature at the feed end. At present the rotary kiln owes what popularity it possesses to its nodulizing feature, in spite of the fact that it is a cheap and efficient roaster, and that it is much more successful, as a roaster, working on coarse than on fine ore. As I remarked above, the sulphur should be practically eliminated from the ore before nodulizing begins. The most satisfactory way of insuring this would be to separate the two processes by using two kilns, but that would be impracticable except in a very large plant, and as a matter of fact the whole operation can be satisfactorily performed in one kiln, provided the latter is not too small. The greatest advantage of separating the processes would be that ringing could be almost entirely eliminated in the desulphurizing kilns, and confined to the nodulizing kilns, which could be made short and of large diameter and great capacity.

It has been the custom arbitrarily to connect a certain diameter with a certain length of kiln. A 60-foot kiln is usually 5 feet in diameter; 80-foot and 85-foot kilns are 6 or 7 feet in diameter, and a 100-foot kiln is ordinarily 8 feet in diameter, but it would frequently be more economical to proportion the kiln in a less haphazard way than by accepting the builder's standard designs. The two determining factors should be the output desired, and the quality of ore to be roasted. The output is de-

A paper read at the annual meeting of the American Institute of Mining Engineers, San Francisco, September, 1915.

pendent on the dimensions of a cross-section of bed of such ore as can be carried in the kiln, the slope of the kiln, and its speed of revolution. The slope of the kiln, however, can be left out of consideration. Good practice places it at ¾-inch to the foot, and increased or decreased output can be better obtained by changing either of the other variables than by changing this. Speed control, too, is a feature of the design of every kiln now, so that this factor may be adjusted to the most satisfactory point after the kiln is in operation. The question of output, then, so far as the kiln design is concerned, is determined by the width and depth of the ore bed. In general, the latter can be increased with the length of the kiln, since the length of time it takes the ore to pass through the kiln will be greater as the kiln grows longer, all other things being equal, but the increased capacity due to the length will not be very great, since, without changing the diameter, the ore bed cannot be deepened to any great extent without harming the roasting process, for which a continual and complete stirring and overturning of the ore bed is necessary. Too great a depth of bed prevents this.

An increase in the diameter of the kiln, on the other hand, increases the possibilities of the output considerably, by allowing the cross-section to be made much greater with a slight increase in depth, giving the desired effect of a greater ratio of surface of ore exposed to the air in comparison with the area of the cross-section. It would seem reasonable, then, to base the length of the kiln entirely upon the time necessary for desulphurization and agglomeration, and to control the output by the diameter.

The question of the speed of progression of the ore in the kiln, upon which, together with the kiln length, depends the length of time necessary for treatment, cannot be accurately determined beforehand, as it is controlled by too many variables. The size of the ore particles, and their shape, the depth of bed, condition of the lining, and the size and shape of the ring all have an effect on the speed of progression of the charge. Fortunately, however, we know from actual practice that any type of cinder can be treated satisfactorily in kilns of from 80 to 100 feet in length, turning at a speed of from one revolution in 60 seconds to one in 90 seconds. The greater length is safer in treating all fine, high-sulphur cinders, since it reduces the chances of a poor product through careless supervision.

The tonnage output of a kiln varies greatly with the kind of cinder charged. A kiln 60 x 5 feet with 4½-inch lining, will treat 1,500 tons a month of low-sulphur lump ore, while on high-sulphur fines, it will with difficulty take care of 750 tons, and frequently even at this low tonnage a large percentage of the product will not be nodulized. A kiln 85 x 7 feet will handle 3,000 tons of high-grade cinder per month, and about 1,500 tons of the poorest grades, while a kiln 100 x 8 feet will vary from 4,500 to 2,500 tons with the quality of cinder treated. A kiln 85 x 8 feet should handle almost as much as the one 100 feet long, but at a greater fuel cost. In general, the larger kiln will have the lower fuel cost and the fine domestic ores will need less coal, on account of their higher sulphur content. On a 60 x 5 feet kiln, the fuel consumption averaged for several months about 12 per cent by weight of the weight of ore roasted.

Mechanical Troubles Eliminated

Mechanical difficulties, which were so common when rotary kilns were first used for the treatment of iron ores, have been practically eliminated. The most important precaution to be observed to insure continuous operation are, to make the kiln sufficiently strong, reinforcing it especially very heavily under the tires, and to keep the operating machinery well protected from the dust. The tires should always be kept tight to the shell, as if any play is allowed the bolt holes will gradually become enlarged, and the kiln will bear down hill so strongly that it will frequently break its thrust bearings. At least an inch of additional metal should be put around the shell under the tire.

The one great obstacle now in the way of continuous operation is the formation of rings, caused by the cinder becoming hot enough to stick to the lining. As soon as the lining is covered the ring increases more rapidly by building up upon itself around an ever-decreasing circumference until it seriously interferes with the operation, and has to be removed. It usually forms in the 15 or 20 feet nearest the discharge end of the kiln, and puts an excess amount of weight upon that end. A piece of the ring is hard and has the appearance of having been partly fused. It looks very much like mill cinder.

Many devices have been tried to prevent the formation of the ring, or to remove it without stopping the kiln, but, so far as I know, none of them have been successful. The best plan, in my experience, has been to shut down the kiln when the ring became too large, cool it off with water, and cut it out with bars and picks. It is impossible, I feel sure, to prevent its formation when running on fine ores. With low-sulphur lump ores that do not need to be nodulized, careful control of the heat will allow a run of indefinite length, but as all the lump cinders (unless screened) carry a considerable percentage of fines sooner or later a shut down will be necessary. On any kind of cinder, however, the formation of the ring can be postponed by keeping, as nearly as possible, the conditions of temperature, speed, and feed, from fluctuating. The temperature should always be kept as low as is compatible with the successful operation of the kiln.

A 9-inch firebrick is generally used for lining, and is probably the best size on the larger kilns. A 4½-inch brick is satisfactory for kilns of 5 or 6 feet diameter. The thicker bricks protect the shell better and prevent warping, but in the smaller kilns they reduce the available diameter too much. The lining wears down rapidly, and frequently individual bricks are loosened or broken in cutting out the ring. If the shell becomes warped under the tires, as is frequently the case when the kiln is not reinforced strongly enough at this point, it is very difficult to keep the bricks in. A 9½-inch lining should last over a year in the hot part of the kiln where the iron ring forms, and considerably longer in the cooler end.

Automatic feeders are frequently used to insure a constant rate of charging, but they are really unnecessary, as the slow motion of the kiln will effect this, if only a simple feed pipe is used. All machinery used in handling the ore and the fuel and in rotating the kiln should be as nearly dust proof as possible, and should be driven by fully inclosed motors, as the fine cinder dust is very harmful. The best plan is to keep the feeding apparatus, the machinery for handling the roasted ore, and the fuel pulverizer and blower, all under separate housings. The kiln itself does not need to be housed, except where such housing is necessary to protect its driving machinery. Powdered coal is used as fuel, so far as I know, exclusively, with the exception of one or two plants where blast-furnace gas has been tried. An oil flame would probably be very satisfactory where cheap oil could be obtained, on account of the ease of controlling the temperature incident to its use.

The cost of production of a ton of roasted ore, aside from the cost of the raw cinder, depends chiefly on the labor cost. Two men on a shift should be able to take care of a well-designed plant producing up to 100 tons in 24 hours, while in a poorly designed plant this number might easily reach four or

(*Continued on page* 1208b).

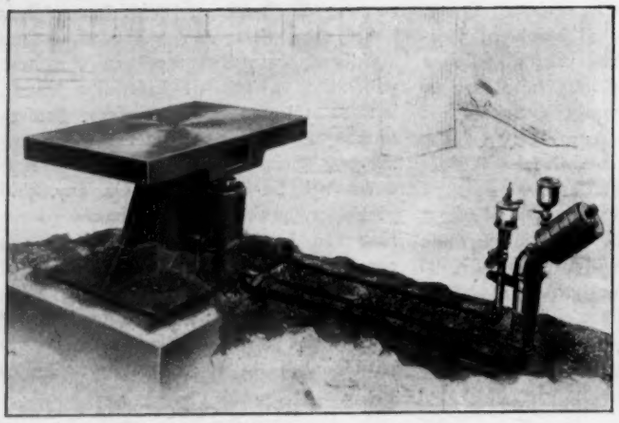


Fig. 1—Plain jar-ramming machine with only sufficient foundation to hold the machine in place

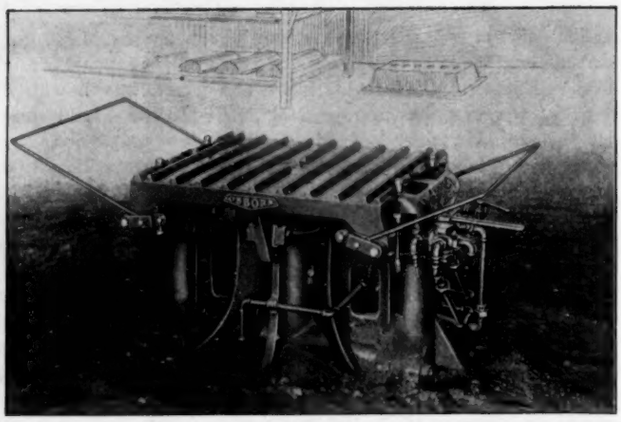


Fig. 2—Foundry floor view of jar-ramming power stripping machine with working parts protected

Foundations for Jar-Ramming Machines

By E. S. Carman

IN ORDER TO intelligently consider the proper foundations required for modern jar-ramming molding machines, it is necessary to review briefly some of the machines of earlier types. In many instances it was considered necessary, to effectively jar-ram a mold, to have a machine that would produce a heavy blow. This usually was accomplished by building the machine with a stroke of 3 to 4 or even 6 inches in length. This stroke, of course, would give the heavy blow, as its action was not unlike the blow which is delivered by a steam hammer. In order to control the ground vibrations produced by such a machine, it was necessary to provide massive foundations, and in many instances the concrete was capped with several layers of wood to aid in the absorption of the blow.

The recent rapid development of jar-ramming machines has practically reversed the early theory of design, as it has been determined that it is not the force of the machine blow that packs the sand, but that it is packed by the jarring table being suddenly or abruptly brought to rest while the sand in the flask to be packed continues its downward course, thereby producing the pressure which results in the sand packing against the pattern or pattern plate. It is quite evident, therefore, that if the machine which has been brought suddenly to rest be instantly started again on its upward stroke and not allowed to pause, that an increased pressure of the pattern against the sand will result, which causes the sand to lay and not rebound.

A jarring machine necessary to accomplish the foregoing need not be unduly massive in its working parts, nor need it have a long stroke, 1 to 2 inches usually being sufficient. It should have means of controlling the force of the blow of the table when contacting with the anvil base, as it is evident that the weight of the moving table, or dead load, must not be allowed to freely drop and contact

Presented at the Atlantic City meeting of the American Foundrymen's Association.

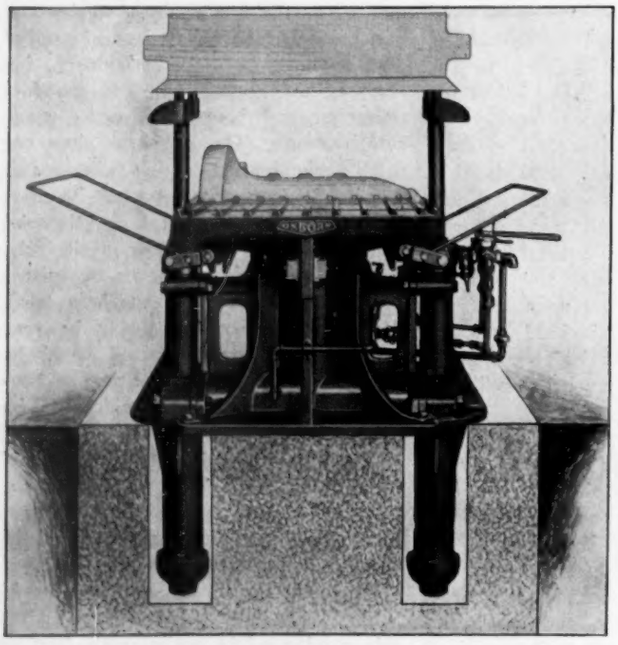


FIG. 3—SAME MACHINE AS FIG. 2, SHOWING SIMPLICITY OF FOUNDATION

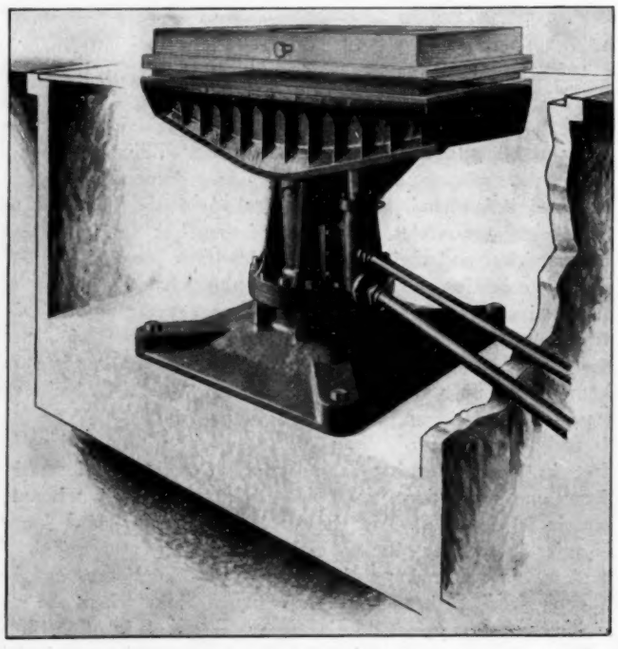


FIG. 4—A LARGE, 42 x 97-INCH, JAR-RAMMING MACHINE, SHOWING THE BASE AND FOUNDATION

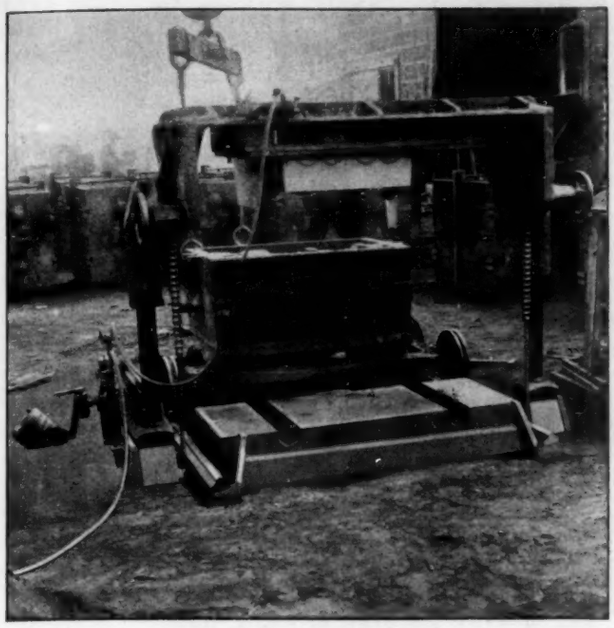


FIG. 5—FOUNDRY FLOOR VIEW OF 54-INCH DIRECT-DRAW ROLL-OVER JOLT MACHINE

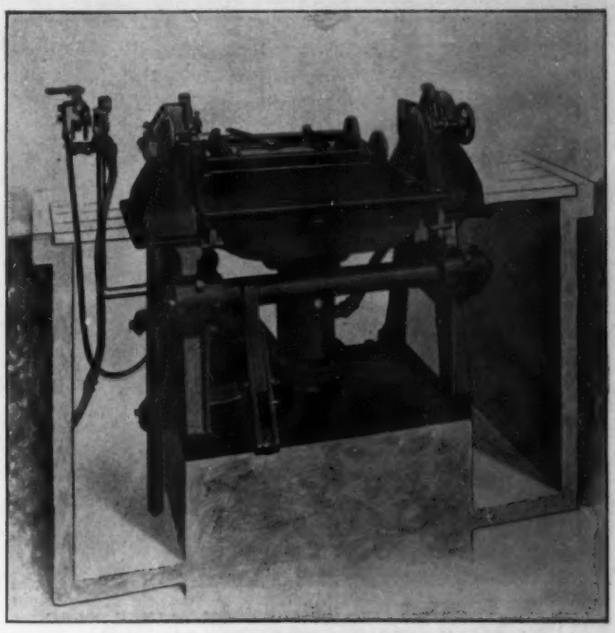


FIG. 6—SAME MACHINE AS FIG. 5, SHOWING SECTION THROUGH FOUNDATION

with the anvil block, or it will produce the unnecessary heavy blow. The up-to-date, modern jarring machine prevents this heavy blow by providing an air cushion under the cylinder sufficient to overcome the violent blow caused by the dead load, allowing only sufficient blow to cause the instant reversal of stroke.

A machine that accomplishes the foregoing not only will ram a good mold in a very short time, but will do so without excessive or detrimental vibration in either the machine, pattern or foundation.

As we now approach our subject—*the machine foundation*—it is evident that with such a machine the extremely massive foundation is not essential and, therefore, our consideration will be from the standpoint of economy and accessibility.

Kind and Nature of the Soil

Of first importance is the kind and nature of the soil upon which the machine foundation is to be placed. A dry gravel is considered the next best thing to solid rock and will safely stand a load of 6,000 to 8,000 pounds per square foot. Dry sand or dry sand and gravel mixed makes a very good foundation base and will withstand a load of 4,000 to 8,000 pounds per square foot. Clay soils vary widely; a soft clay will flow in all directions under very light load, and should not be loaded more than 3,000 pounds per square foot, while a dry clay will satisfactorily stand a load of 3,000 to 5,000 pounds per square foot. If the foundation is to be placed on *made* ground or *fill*, provision should be made to keep the ground perfectly dry and free from water. With this condition existing a satisfactory foundation can be made, which is more desirable than a wet or oozy clay soil.

When the machine foundation is placed on *clay* or *fill* better results can be obtained by making the foundations cover a larger area rather than making it of greater depth, unless the fill is of such depth that the foundation may be extended through. It must be remembered that when

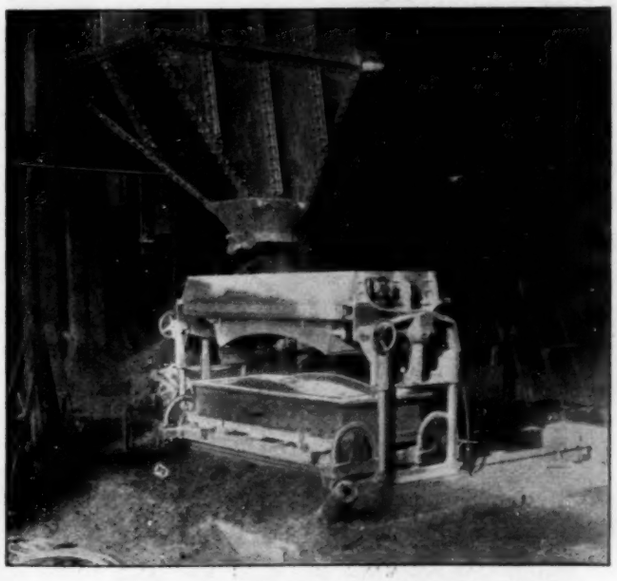


FIG. 7—VIEW OF LARGE, 36 x 150-INCH DIRECT-DRAW ROLL-OVER JOLT MACHINE

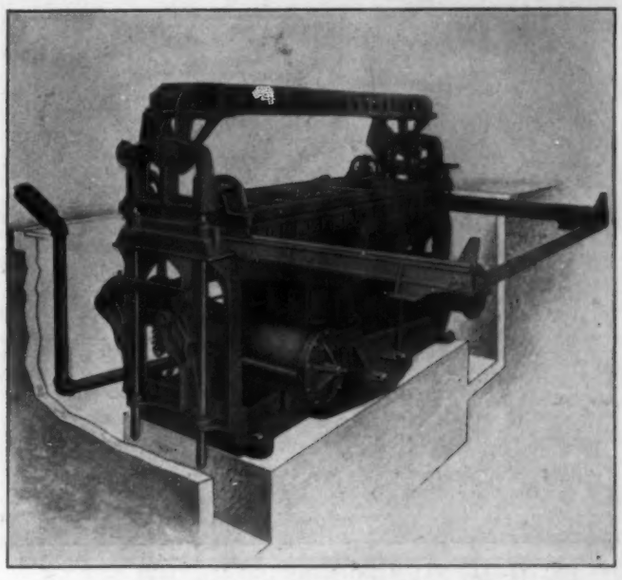


FIG. 8—SAME MACHINE AS FIG. 7, SHOWING SECTION THROUGH FOUNDATION

FIG. 9—FOUNDRY FLOOR VIEW OF 42-INCH ELECTRICALLY-OPERATED DIRECT-DRAW ROLL-OVER JOLT MACHINE, WITH BASE AND FOUNDATION SHOWN IN PHANTOM

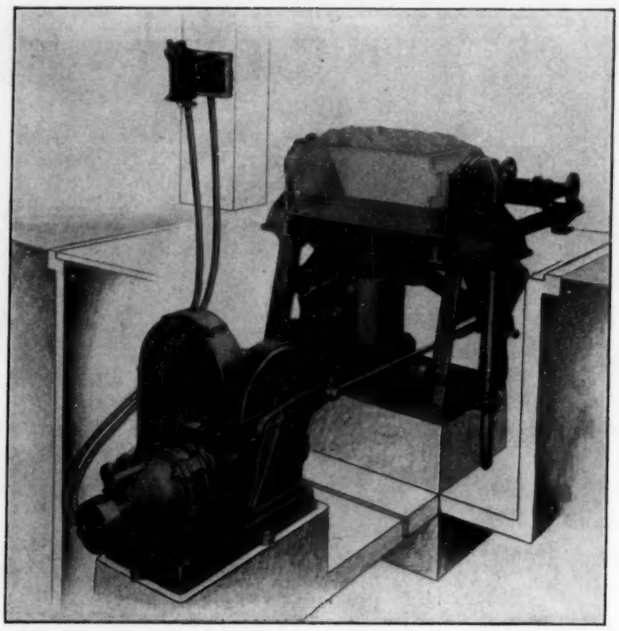


FIG. 10—SAME MACHINE AS FIG. 9, SHOWING SECTION OF FOUNDATION

we place a molding machine in the foundry that we are actually violating the old established principle of machine installation and *placing it in a sand pile* instead of an engine room, or other dirt and dustproof room, and yet notwithstanding this extraordinary condition and without giving the machine proper care, many foundrymen expect as good results from the machine in the sand pile as they do from the machine that was placed in a dustproof room and in charge of an expert mechanic.

The accompanying illustrations will demonstrate that it is economy to provide a foundation and setting that will give ample protection to the machine, by making it impossible for sand to collect on the machine or its moving parts.

The illustrations also show the advisability of providing ample space around the machine so that the mechanic can easily oil, inspect and keep the working parts in order, the same as he does the machine that was placed in the engine room. The depth of the space surrounding the machine should be sufficient for a man to stand erect, suitable lighting facilities should be provided and a stairway or ladder should lead into the pit. The covering of the foundry floor should be made of 2-inch matched planking and should be fitted tight against the machine. The trap door leading into the pit should be hinged and of ample size.

Fig. 1 shows a simple, plain jar-ring machine of such size as not to require a pit, the foundation being only sufficient to hold the machine in place. The design of the machine permits the sand to be filled around the base, as all working parts are protected from the sand and grit.

Fig. 2 is a foundry floor view of jar-ram, power-strip machine, having all of the working parts well protected. Fig. 3 is the same machine as Fig.

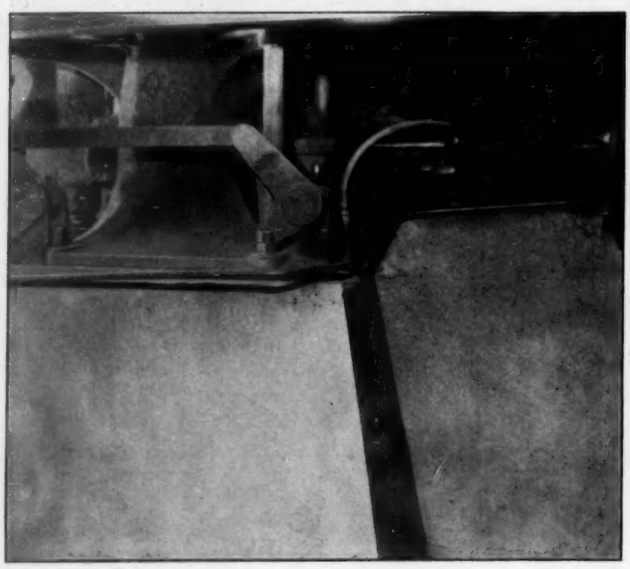


FIG. 11—JAR-RAMMING MOLDING MACHINE SET ON A PIER

FIG. 12—JAR-RAMMING MOLDING MACHINE FOUNDATIONS AT THE PLANT OF THE CENTRAL FOUNDRY CO., HOLT, ALA.

2, showing the simplicity of the foundation.

Fig. 4 is a section through the base and foundation of a large 42 x 97-inch plain jar-ramming machine.

Fig. 5 is a foundry floor view of

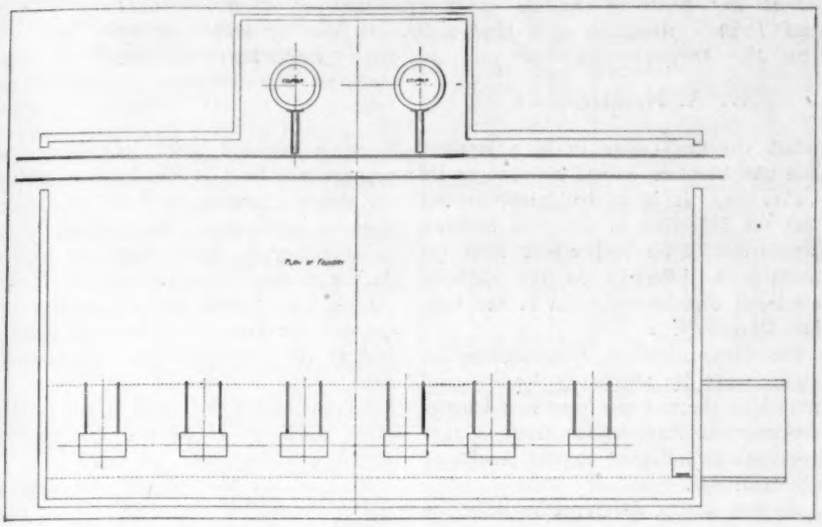


FIG. 13—PLAN VIEW OF A PROPOSED FOUNDRY HAVING A TUNNEL OR BASEMENT FOR SETTING MACHINES

54-inch, direct-draw, roll-over jolt molding machine.

Fig. 6 is the same machine as Fig. 5, showing a section through the foundation.

Fig. 7 is a foundry floor view of a large 36 x 150-inch, direct-draw, roll-over, jolt molding machine.

Fig. 8 is the same machine as Fig. 7, showing a section through the foundation.

The foundations shown in Figs. 6 and 8 illustrate clearly the necessity for providing suitable space around the machine, and also the advantage to be gained by placing the machine base on a pier, thereby making it possible to keep the machine free from sand or dust accumulation.

Fig. 9 is a foundry floor view of a 42-inch electrically-operated, direct-draw, roll-over jolt molding machine with base and foundation shown in phantom. Note the position and simplicity of controllers.

Fig. 10 is the same machine as Fig. 9, showing section of the foundation and illustrating clearly the provision made for the motor base. Note that the foundation of the machine and of the motor base are cast separate, thus preventing the vibrations from reaching the motor.

Fig. 11 is a view taken at the plant of the American Steel Foundries, Alliance, O., showing the advantage to be gained by setting the machine on a pier. Note the freedom from dirt and dust.

Fig. 12 is a view taken at the plant of the Central Foundry Co., Holt, Ala., showing the most approved manner of providing foundations. The cylinders of the machines extend through the ceiling of this basement leaving only the jolt table exposed on the molding floor above. Seven machines are in this row, all of which are readily accessible.

The engineer or architect called upon to design and build the foundry of tomorrow will do well to thoroughly consider the best method of installing and maintaining the molding machines to be used, placing them in such a manner as to insure ample protection from dust and grit, making it easy to give the machine the care and attention it deserves.

The author's idea of a foundry that will best meet these requirements is set forth in Figs. 13 and 14. These illustrations show the plan and cross-section of a proposed foundry, having a tunnel or basement extending the full length of the molding floor. The floor of this tunnel or basement should be at least 7 feet below the ceiling and the width should be sufficient to allow a clear passageway on one side of the machines; the piers for the machine foundations can be placed at any time and to suit any condition.

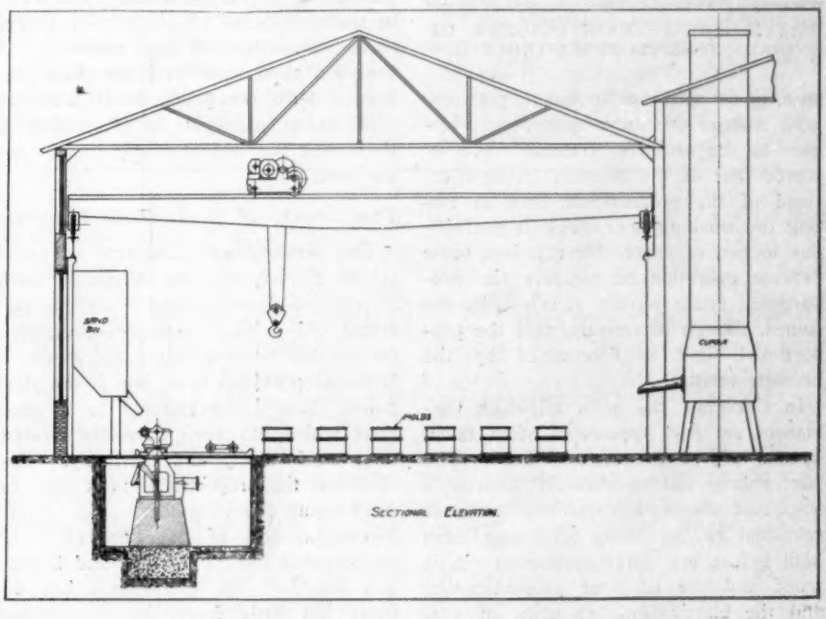


FIG. 14—CROSS-SECTION OF THE PROPOSED FOUNDRY

Use of Steel Cleats

A corrugated steel cleat for use on kegs and barrels has recently been put on the market by Hubbard & Co., Pittsburgh. This cleat is made of light gage steel and has a deep corrugation or rib extending its entire length. This design is said to give the cleat a strength practically equal to that of a solid bar of the same diameter. The ends of the cleat are curved. Their length and shape permit the ends to fit snugly over the hoop while the ribbed portion lies flat and tight against the head of the barrel. Holes are provided in the ends for driving nails through both the hoop and stave, thus embedding the full length of the nail in the wood. It is claimed for this cleat that it is not only stronger than any previous device used for holding in the heads of barrels but that it will effect a saving of more than half of the nails ordinarily required. The strength of this cleat furnishes a guaranteed protection against the heads becoming loose and permitting the contents to fall out. The cleat is made in sizes to suit all standard kegs and barrels.

Proportional Limit is Prime Factor

THIS EMINENT Russian engineer considers the proportional limit as the foundation of all calculations, declaring it independent of the yield point and the tensile strength. He believes that the wear of metals is independent of their ultimate strength, yield point, and Brinell number, and that wear by flow of metal or by crushing depends only on the proportional limit, as do other important factors.

By A. N. Mitinsky

THE theory of elasticity, the science of the strength of materials, and all our calculations regarding engineering structures are based on Hooke's law, that in loaded bodies the deformations are proportional to the load producing them. Without this law it would be impossible to design intelligently engineering structures such as bridges, frames, axles, etc. This being the case, the proportional limit, that is, the point at which deformation ceases to be proportional to load, is a most important factor in engineering design. Further, the working fiber stress should

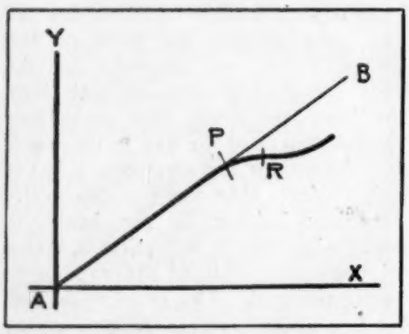


FIG. 1—STRESS-STRAIN DIAGRAM OF GOOD STEEL PROPERLY TREATED

be fixed in reference to the proportional limit instead of, as is usual, in reference to the ultimate strength. The incorrect use of the ultimate strength instead of the proportional limit in setting the working fiber stress is probably due to two reasons: First, it is a more delicate operation to measure the proportional limit; second, it is usually assumed, though incorrectly, that the proportional limit is determined by the ultimate strength.

In Germany, the point at which permanent set first appears is often taken instead of the proportional limit. The two points will coincide if Gerstner's law, that elastic deformations are proportional to the loads producing them both before and after permanent set, is true; and the limit of proportionality and the elastic limit or point of permanent set will both be represented on a stress-strain diagram, by the point at which the line ceases to be a straight line and becomes curved or changes its inclination. It is to be further noted that the difference in definition between proportional limit and elastic limit introduces a difference in the methods employed for determination in the testing laboratory.

The German method of determining the elastic limit by alternately loading and unloading the test specimen is a lengthy process, and time has in itself a very considerable influence on the results of physical tests.

In this way a difference in definition may lead to a difference in the determination of the point sought. The real danger from erroneous ideas regarding the material to be tested lies, however, not in this possible difference of measurement, but in the mistake, so common in Europe, of considering the yield point as the "practical elastic limit." This is only true in the sense that the yield point can be measured practically and simply, but is not true in the sense that a measurement of the yield point will give a correct idea of the elastic qualities of the metal tested. The value of the yield point has no relation to the elastic properties of the material. If the yield point stood in fairly close connection with the proportional limit we could use it in judging of the quality of the metal, but unfortunately this is not the case.

Two Groups of Stress-Strain Diagrams

The stress-strain diagrams of steel can be divided into two groups, of which Figs. 1 and 2 are typical. In these diagrams, *AB* is the line representing proportionality between stress and strain, *P* is the proportional limit, and *R* the yield point. Fig. 1 corresponds to a good steel which has been correctly treated, both mechanically and thermally. This steel has the proportional limit and the yield point close together. Fig. 2 represents a steel of poor quality. The proportional limit *P* is low, and beyond this point, *P*, the stress-strain line departs but little from the proportional line *AB*, until the yield point, *R*, is reached. A steel with a diagram of this character may show good elongation and reduction of area and a high ultimate strength, but is extremely undesirable for use in railroad service. From a physical point of view, the proportional limit is the load at which the shearing stresses produced by a tension or compression load become sufficiently large to break down the metal. At the moment when this occurs, Hartmann's lines appear on the surface of the test specimen, which becomes dulled, and at the same time the temperature rises. After a stress of this magnitude has been applied the metal is not in the same condition as before, its internal structure having been deformed.

By gradually loading and unloading a test specimen, the proportional limit can

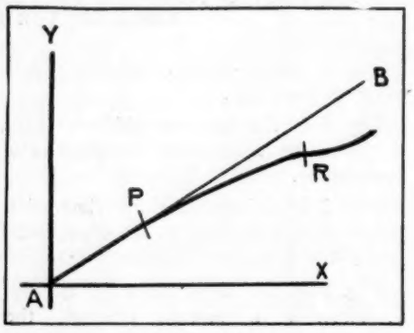


FIG. 2—STRESS-STRAIN DIAGRAM OF POOR QUALITY STEEL

be raised, and in many cases where the stress-strain diagram is of the type shown in Fig. 2, the increase is a substantial one. The proportional limit cannot, however, be carried above the yield point, and any blow or shock will reduce the artificially raised limit. It is further to be noted that this artificial raising of the proportional limit in tension is accompanied by a corresponding reduction in the proportional limit in compression, and inversely.

By subjecting metal to repeated and alternating tension and compression metal can be destroyed by so-called fatigue, with loads very much below the ultimate strength. The resistance to fatigue depends solely on the proportional limit of the metal and is not due to some other special property. If the stress under repeated loads is less than the proportional limit no change occurs in the metal and no repetition of such a stress will cause injury, since the internal structure of the metal remains undisturbed. On the other hand, if the repeated stress exceeds the proportional limit, the metal

A paper read at the San Francisco meeting of the American Institute of Mining Engineers, Sept. 16 to 18, 1915. The author is chief engineer, department of tests, Russian state railways.

will be deformed and eventually ruptured. On the first application of the load producing such a stress, say in tension, a permanent deformation is produced, the shearing stresses do internal work, and the elastic limit in tension is increased. When the load is reversed on the following alternation, the previously extended fibers are compressed and permanent deformation in compression is produced. This is the greater because the elastic limit in compression has been lowered by the previous deformation under tension. This process repeats itself, the metal being increasingly changed internally at each alternation. In so far as fatigue of metal is concerned the proportional limit may be compared to the critical temperature in physics.

It would appear from the foregoing that the fatigue test, with stresses above the proportional limit, which is required by some English railways for tires and axles, could be replaced in practice by a determination of the proportional limit. It is sometimes said that a determination of the proportional limit is an impossibility in ordinary commercial testing, and doubtless the usual German method of making such determinations by applying and releasing the load has done much to justify this opinion. It is, however, a fact that in the Russian railway material inspection tests, determinations of the proportional limit are currently made and do not occupy more than 15 to 20 minutes each. A mirror apparatus and extensometers are used. In this inspection testing it is not of importance to determine the exact value of the proportional limit, but rather to make sure that it is not less than 20 or 25 kilograms per square millimeter (28,400 or 35,500 pounds per square inch), as the case may be. In case the proportional limit is found to be less than the specified value, the tires are rejected.

Having established the possibility of using the proportional limit in the specifications, the Russian railways are now introducing it into their rail specifications.

The wear of rails and tires is of two kinds, a crushing action producing a flow of the metal, and an abrasive action. Wear of the first kind, by deformation, depends, as has been just explained, only on the value of the proportional limit. Practical experience has shown that failure by deformation may occur in rails with high as well as with low tensile strength, but that it is in every case accompanied by a low value of the proportional limit and that it is independent of the value of the yield point.

Table II.

CHARACTER OF DEFECTIVE USED RAILS FROM SIBERIAN RAILROAD

Carbon.	Manganese.	Silicon.	Phosphorus.	Sulphur.	Ultimate stgth.	Elongation.	Area contraction.	Yield point.	Elastic limit.	Brinell number.
0.55	0.35	0.011	0.036	0.01	65-67	11.5-17	27-35	38-45	9.5-9.5	158
0.55	0.22	0.007	0.069	0.006	68-73	13.5-19	27-37	27-39	9.5-10.5	161-174
0.45	0.44	0.034	0.043	0.007	62-64	13-14	44-46	38	16	150
0.63	0.39	0.013	0.037	0.005	71-71	14	24-28	28	9.5	180
0.54	0.42	0.012	0.055	0.029	63-66	15-19	31-42	40-47	10.0-14.5	156-167
0.37	0.22	0.009	0.051	0.020	58-61	11-20	44-50	35-46	16	154-158
0.38	0.44	0.012	0.085	0.019	59-63	13-44	43-50	43	16	158
0.48	0.66	0.018	0.035	0.025	66-68	13-19	37-40	45-50	14.5-16.0	158-167
0.42	0.86	0.040	0.087	0.008	61-68	11-20	51-55	41-55	16-22	156-176
0.56	0.59	0.012	0.046	.....	78-80	8-15	11-24	45-47	13-16	187-194
0.48	0.57	0.012	0.031	0.018	65-70	13-18	26-40	42-49	10-11	160-176
0.54	0.35	0.018	0.036	0.023	63-68	13-20	35-40	35	9.5	153
CHARACTER OF DEFECTIVE UNUSED RAILS FOR SIBERIAN RAIROAD										
0.69	0.44	0.028	0.050	0.029	85-87	9	16	49	12.5	194
0.65	0.73	0.17	0.083	0.021	73	17-18	31-36	41	19.5	168
0.61	0.18	0.09	0.045	0.029	75-76	14	21-25	41	20.5	174
0.50	0.36	0.03	0.035	0.021	68-69	17-18	29-36	45	16.0	163
0.63	0.25	0.017	0.053	0.021	79-80	13-14	26-27	47	20.5	185
0.55	0.39	0.09	0.043	0.038	73-75	15-16	22-32	34	16.5-24.5	174-180
0.57	0.36	0.11	0.060	0.039	80-81	11-14	21-25	37	29.0	194

Table. I.

RESULTS OF RUSSIAN RAIL TESTS

Millions of tons carried by rail.	No. of rails.	Per cent of carbon. Min.	Max.	Mean.	Ultimate tensile strength, pounds per square inch. Min.	Max.	Mean.	Brinell hardness number. Min.	Max.	Mean.
10 or less	46	0.165	0.615	0.411	72,500	118,000	92,500	163	233	194
10 to 50.	72	0.127	0.705	0.342	65,400	118,000	88,200	144	246	191
Over 50.	19	0.135	0.725	0.375	68,300	102,400	86,800	139	224	192

In the years from 1899 to 1906 a special committee was appointed by the Russian government to investigate the causes of rail wear and to work out means for securing satisfactory service from rails.

Rail Tests

The special committee studied the question thoroughly. A large number of rails made by manufacturers in Russia and other countries were subjected to chemical analysis and numerous physical tests, the rails being chosen so as to include those which had given the best as well as those having given the worst results in service. Table I sums up some of the results obtained. All tests for Russian railways are made using the international standard test specimen and the metric system.

In addition to other tests, drop tests were made on pieces of rail 5 feet long,

Table III.

ANALYSES OF WORN LOCOMOTIVE TIRES

Total run in thousands of versts[1].	363	337	337	329	289	284	2.73	2.38	1.71	165	164	152
Yrs. of ser.	11¼	12	1-12	10¼	11¼	12 ½	13 ½	7	5-6	9	11-12	6	7-12	10	1-6	6	1-12	5	5-12
Load per axle, tons.	13.3	13.3	13.3	13.3	13.3	13.3	14.4	14.0	12.8	14.4	14.4	13.3
Ultimate strength,												
a	70.0	71.0	69.0	64.5	70.5	70.5	67.5	....	....	75.5	57.5	69.5
b	63.5	74.0	67.0	62.0	67.5	70.0	69.5	73.0	69.0	78.0	52.5	65.5
c	68.5	74.0	70.0	67.0	68.5	71.0	71.5	77.0	64.5	83.0	55.0	76.0
Elongation,												
a	8.0	6.5	14.0	23.5	20.0	15.5	14.5	....	....	13.0	21.0	14.5
b	17.5	13.0	18.0	17.0	15.5	16.5	15.0	17.0	15.0	12.5	28.5	13.5
c	20.0	13.5	14.5	11.5	6.5	15.5	10.5	12.0	13.5	13.5	23.5	12.5
Area contraction,												
a	....	13.0	31.0	31.0	40.0	39.0	28.0	....	....	20.0	34.0	35.0
b	62.0	29.0	39.0	41.0	24.0	32.0	34.0	33.0	39.0	23.0	43.0	46.0
c	39.0	23.0	38.0	26.0	10.0	35.0	32.0	28.0	42.0	30.0	45.0	23.0
Elastic limit,												
a	29.0	27.0	26.0	23.0	33.0	28.5	18.5	....	....	21.0	22.0	29.5
b	22.5	25.5	19.0	27.0	30.0	31.5	29.5	28.5	27.5	32.0	17.0	31.5
c	31.5	25.0	26.0	35.5	32.0	25.0	22.5	31.0	27.0	40.0	20.5	25.5
Average ...	28.0	26.0	24.0	28.5	32.0	28.0	27.0	30.0	27.0	31.0	20.0	29.0
Carbon ...	0.460	....	....	....	....	....	0.500	0.560	0.470	....	0.420	0.460
Manganese	0.980	....	....	....	....	....	1.020	1.100	1.060	....	0.780	1.070
Silicon ...	0.090	....	....	....	....	....	0.121	0.197	0.181	....	0.191	0.292
Phosphorus	0.026	....	....	....	....	....	0.036	0.021	0.025	....	0.027	0.039
Sulphur ...	0.018	....	....	....	....	....	0.022	0.033	0.018	....	0.440	0.020

[1]One verst is equal to 1.065 km. or 0.66175 mile.

by dropping a ½-ton tup from a height determined by formula. The permanent deflection after the first blow was noted in each case, the figures obtained being as follows: For good rails having given long service, from 1.8 to 3.2 inches, average 2.5 inches, the best showing 2.6 inches; for rails with crushed heads, 2.2 to 3.0 inches, average, 2.6 inches; for rails rapidly worn by abrasion, 2.1 to 3.1 inches, average, 2.5 inches. The committee was unable to establish any definite relation between the wear obtained from the rails in service and the ultimate strength, Brinell hardness, yield point, elongation, reduction of area, chemical analysis, or deflection on drop test.

About four years ago, more than 20,000 tons of rails on the Siberian railroad were found to be defective. These rails, which were all from the same steel works, showed crushed heads soon after having been laid. Table II summarizes the results obtained by the laboratory of means of communication at Petrograd. The first 12 lines give particulars obtained from rails which had been in service, while the last seven lines refer to rails selected at the works. Several test pieces were taken from each rail and the maximum and minimum results are given in the table. It is evident that all 12 rails which crushed in service had low values for the proportional limit. In some cases it was only one-quarter of the yield point. On further investigation it was found that the works, in the endeavor to secure a large output of rails from a weak mill, had finished them too hot.

The investigation of the influence of the proportional limit was continued by an examination of 12 tires from locomotives in main-line service on one of the Russian railroads. The tires were chosen from those removed from service after having reached the normal limit of wear, those showing the best mileage being selected. Three test pieces were cut from each, as near to the outer circumference as possible: Sample *A* from the flange, *B* from the center of the tread, and *C* from the face edge of the tread. The results are shown in Table III. All of these tires which have given good results in service show a high value for the proportional limit, the average for all being 39,000 pounds per square inch.

If the rolling of a rail is finished at a high temperature, the value of the proportional limit will be low, so that a measurement of the proportional limit will show whether or not the rolling was properly done. Again, tires will show a low proportional limit if improperly annealed; that is, if the critical temperature of, say, 875 degrees Cent., has not been reached, or if the internal critical temperature has not been passed rapidly enough during cooling. An unannealed tire rolled at too high a temperature will also show a low value for the proportional limit.

Generally speaking, a steel having a medium amount of carbon and a fine regular internal structure will have a high value for the proportional limit. There are, however, two cases in which a high proportional limit does not correspond to a good steel. These are: Overheated steel, widmanstadt's structure; a high phosphorus or arsenic, or too much manganese in combination with a comparatively high percentage of carbon. In both cases the metal with a high proportional limit may be brittle, but this condition will be disclosed by a drop test.

Denies Brinell Relation to Hardness

It may therefore be concluded that if a rail or a tire shows a high proportional limit and sustains satisfactorily a drop test, the steel is of as good a quality as can be desired, and no attention need be paid to the ultimate strength or Brinell hardness, these two being practically the same thing, nor to the elongation, reduction of area, carbon, manganese, etc.

The foregoing has dealt with wear of rails and tires by flow of metal. The wear by abrasion has not yet been studied as closely as it deserves. Practically, all that can be said at present is that sulphur in steel tends to increase abrasion, as it segregates sharply and may be present on the wearing surfaces in considerably higher quantities than in the average analysis of the ingot. Many persons are of the opinion that the ultimate strength has a great influence on the resistance of the steel to abrasion, but the author has been unable to find any sound basis for this opinion. At the meeting of the International Society for Testing Materials in New York in 1912, Robin, Saniter, Rosenhain, and at Copenhagen in 1908, Musbaumer proved that this opinion is erroneous. The same conclusions were reached by the Russian rail committee referred to above. The author therefore feels that the only honest answer to the question "On what does the abrasive wear of steel depend?" is "Except in the particular case of sulphur, we do not know."

It is sometimes said that the Brinell hardness number bears a relation to the abrasion, but the absence of such a relation was shown by the same tests as disproved the theory of a relation between abrasion and ultimate strength. The reason is clear. The scientific determination of hardness by Hertz in 1882, defines it as the value of the normal pressure per unit of area at the center of the bearing surface of a spherical body at the moment in which the elastic limit is attained. Auerbach was the first to carry practical tests beyond the elastic limit, and in all Brinell's experiments this limit is exceeded and permanent plastic deformations alone measured. It follows that Brinell hardness numbers can be related only to the ultimate strength and are quite foreign to the true hardness and therefore to the wear by abrasion.

The author formulates the following suggestions regarding the quality of metal generally:

The proportional limit is the proper basis of all engineering calculations.

The proportional limit is independent of the yield point and of the tensile strength.

The proportional limit is the most important property, and should be as high as possible, especially for metals subjected to repeated loads, shocks, wear by crushing, etc.

The wear of metals of all kinds is independent of the ultimate strength, yield point, and Brinell number.

Wear by flow of metal or crushing depends only on the proportional limit. Wear by abrasion is not completely studied and it can only be said that sulphur has a deleterious influence.

The proportional limit can and should be measured in engineering inspection of materials.

The allowable working stress of any material should be fixed as a proportion of proportional limit.

The resistance to fatigue is directly dependent on the proportional limit and provided this is not exceeded, no number of repeated stresses will destroy the metal.

The C. & G. Cooper Co., engine manufacturer, Mt. Vernon, O., reports a considerable increase in business. The company advises that it has sold 13 engines recently, including both gas engine driven air compressors and corliss steam engines. One of the largest orders was for a 44 x 74 x 54-inch tandem corliss engine for the Edgar Thomson Works of the Carnegie Steel Co., Pittsburgh.

The Republic Structural Iron Works Co., Cleveland, is now publishing a very interesting monthly bulletin under the heading of "The Republic Structural News". This booklet is attractively printed and the subject matter should prove of value to those interested in structural products. The booklets in addition contain the company's monthly price list.

The United Engineering & Foundry Co., Pittsburgh, has given machinists employed at the Lloyd-Booth plant at Youngstown a slight increase in wages.

News of Employers and Employes

Seattle Manufacturers Declare for Fair First Aid Law and Industrial Survey—Labor Troubles Multiply in New England

THE labor situation presents no serious phases as regards disagreements. Employers have been hard put in many cases, however, to preserve their organization against the time when business shall again become normal.

The methods adopted by Seattle and the state of Washington in handling labor have been approved by United States Commissioner of Immigration Caminetti, who spent some time in Seattle recently studying the situation. Washington has done away with the private employment agent and it is to gain knowledge of the practical application of this law that the commissioner is making his study.

The Manufacturers' Association of Seattle has gone on record in favor of a fair first aid law, the governor having vetoed the measure which came up for passage at the last legislature. The waiting period after the injury is received before compensation should begin was the rock on which the forces split. The association favors a general conference committee comprising employers, employes and state commissioners interested to meet some time in the future to frame the law for presentation at the next session of the legislature. The trustees of the association also ordered the beginning of an industrial survey of Seattle to be undertaken in co-operation with the bureau of foreign and domestic commerce, and the Chamber of Commerce and other industrial organizations.

The report of the industrial insurance commission of Washington for the year ending October 1st, 1915, shows that 210 people lost their lives in hazardous occupations. The claims in 22 of these cases were disallowed and 188 favorably acted upon.

At the second annual convention of the National Association of Industrial Accident Boards and Commissioners held in Seattle some time ago, a report was submitted by Robert K. Orr, secretary of the committee on statistics and compensation insurance cost and manager of the state accident fund of Michigan. The committee recommended the use of a standard set of classification groupings which would largely increase the number of groupings in Washington. The groupings, 273 in all, recommended by the committee for classification are included under several general heads as follows:

Agricultural, mining, quarrying, manufacturing, construction, transportation and public utilities; trade, all undivided, but including offices, stores, yards, salesmen and outside agents; service embracing domestic, personal, professional, municipal and public.

New England Troubles

New strikes have broken out in several Massachusetts and Connecticut manufacturing establishments the past week and it is feared that they may extend to some of the big war munitions plants in Bridgeport, Ct., where thousands of men and women would be idle, in consequence. More than 3,500 members of the International Association of Machinists, at three meetings in that city recently, voted to walk out on strike the next day at the big plant of the Remington Arms & Ammunition Co.—Union Metallic Cartridge Co., as a result of alleged discriminations against officers of the union by foremen of these companies. Three officers of the grand lodge who were in Boston at the time rushed to Bridgeport and held off the strike until there could be a conference with officials of the companies. The grand officers know that a strike is not necessary for the men to obtain their demands, as Maj. Walter G. Penfield, general manager, on Nov. 27, when an ultimatum was placed before him, offered liberal terms for a settlement without a strike. These officers say that the conditions are now the same, and they want to prevent the strike. The company employs about 8,000 hands.

One of the places where new labor troubles developed is the plant of the Winchester Repeating Arms Co., in New Haven, Ct., employing 18,000 persons. The officials of the company claim that not more than 200 are on strike while labor leaders assert that the number is 900. It started when 86 toolmakers struck for increased wages of 15 per cent and an 8-hour day and the number has been added to daily since. The company states that the 200 men in allied branches of the cartridge department, who also made a wage demand, but did not go out, have accepted the explanation of the company on the wage situation and they will not strike. The company's officials also state that last August the tool makers were given a 48-hour week without a decrease in the wages they were receiving for a 55-hour week. As a result of the strike, a general demand for the 8-hour day in place of the 55-hour week is to be presented the company by the tool makers and machinists and if the reply is not favorable, they are expected to walk out.

Another small strike recently was at the plant of the Knox Motors Co., in Springfield, Mass., 65 of the 400 employes walking out. The employes at a meeting Dec. 2, voted to strike unless a demand for recognition of the union shop committee, time and a half for time over the daily working schedule and double time for Sundays and holidays are acceded to at a conference of union representatives and company officials. While the latter were considering the demand, the business agent of the union called the men out and but 65 responded. The company later announced that it had decided to grant time and a half for overtime and double time for Sundays and holidays. General Manager E. O. Sutton of the company, says that all the employes are union men and that the shop committee will be recognized as representing the employes. The 65 men have not since returned to work and have picketed the shop.

Nine non-union molders employed in the foundry department of the Rice, Barton & Fales Machine & Iron Co., Worcester, Mass., where there is a strike on, struck recently because they claimed they were dissatisfied at conditions, refusing to work with molders of the National Foundrymen's Association, who were drawing larger wages for the same work. The employes of the machine shop departments of the company have voted to make a demand for the 48-hour week, time and a half for overtime, double time for Sundays and holidays, and an increase in wages per hour. It will be presented to George S. Barton, president of the company shortly.

The strike which has been in effect at the plant of the Rhode Island Perkins Horseshoe Co., Valley Falls, R. I., the past three months has been called off by vote of the union and the 300 men have returned to work.

Iron Ore Prices for 27 Years

Second Buying Movement in 1915 Starts at Advance of 75 Cents Over 1914—Comparison With Pig Iron Quotations

THE buying of lake iron ore for delivery in 1916 was started Tuesday, Dec. 7, as reported in last week's issue of *The Iron Trade Review*. There were no large or spectacular sales, nor was there anything sensational connected with the opening. While opinions had differed as to whether the price should be $1 or 75 cents above the price for 1915 delivery, the practically simultaneous sales made Tuesday and Wednesday at an advance of 75 cents have established the price which doubtless will prevail throughout the seeason. Many reservations have been changed into contracts and a large tonnage of ore has been sold.

The present year has thus become the fifth in which there have been two buying movements, the others being 1899, 1905, 1909 and 1912. The buying season for 1907 was the earliest on record, as it started Nov. 2, 1906, and within a week practically all the ore for sale had been disposed of. Next to that early buying came the buying for delivery for 1906, with Dec. 5, 1905, as the date of the movement, and 1890 and 1900 each with Dec. 15 of the previous year as the date of the buying movement.

The year 1908 will always be remembered on account of the refusal of the buyers to accept the prices named in February of that year. The panic occurred in October, 1907, and contrary to the judgment of some of the wisest men in the ore trade, the 1907 prices were reaffirmed for 1908. Owing to the general refusal of furnaces to place their orders, prices were reduced 50 cents per ton on June 15, 1908, and the buying which was started was the latest on record. In 1909, many reservations were made during the early months and there was little buying, but prices were not determined until May 10, 1909. In 1910, all the bessemer ore available was reserved before prices were established and reservations were quickly turned into actual sales when prices were announced. Some non-bessemer ore was also sold early, but sales of the remaining tonnage dragged throughout the year. In 1911, the selling of ore was started by W. P. Snyder & Co. selling 550,000 tons at a reduction of 50 cents from the price of 1910. In March, 1912, the first sales were made by Pickands, Mather & Co., who also opened the market for 1913 by the selling of several million tons. Very reluctantly, in 1914, the ore sellers came to the conclusion that it would be necessary to sell at the very low prices of 1912 and the buying was started May 1, but there was very little activity in the market and buying dragged throughout the year. Conditions prevailing in the spring of 1915 were similar to those of the spring of 1914, and the 1914 prices were reaffirmed on April 19, 1915. The buying was very slow at the start, but all the ore that could be shipped was sold before the close of the season, when improvement in the iron business brought increased demand for ore and some furnaces were unable to cover for their requirements. The delivered price of Messabi ores was reduced 5 cents when the reduction was made in the freight rate from Mesabi mines to docks.

Table I.

SELLING PRICE OF IRON ORE AND PRICE OF PIG IRON AT DATE OF BUYING MOVEMENT 1890-1916.

Season.	Date buying movement.	—Season Iron Ore Prices— Old range Bessemer.	Mesabi Bes'm'r.	Old range non-Bes'm'r.	Mesabi non-Bessemer.	—Iron Prices— Valley Bes'm'r.	Foundry Iron No. 2.
1890	Dec. 15, 1889	$5.50	no sale	$5.25	no sale	$22.15	$18.15
1891	June 1, 1891	4.50	no sale	4.25	no sale	15.15	15.00
1892	Jan. 31, 1892	4.50	no sale	3.65	no sale	15.00	13.65
1893	Mar. 15, 1893	3.85	$3.00	3.20	no sale	12.65	12.15
1894	Mar. 1, 1894	2.75	2.35	2.50	no sale	9.65	9.65
1895	April 1, 1895	2.90	2.19	2.25	$1.95	9.40	9.40
1896	May 1, 1896	4.00	3.50	2.70	2.25	12.40	11.15
1897	May 20, 1897	2.60	2.25	2.15	1.90	8.35	8.40
1898	Mar. 20, 1898	2.75	2.25	1.85	1.75	9.55	9.80
1899	Feb. 1, 1899	3.00	2.40	2.15	2.00	10.30	9.75
1900	Dec. 15, 1899	5.50	4.50	4.25	4.00	24.15	22.15
1901	Apr. 15, 1901	4.25	3.25	3.00	2.75	16.15	14.40
1902	Feb. 1, 1902	4.25	3.25	3.25	2.75	15.90	15.90
1903	Mar. 20, 1903	4.50	4.00	3.60	3.20	21.50	21.65
1904	Apr. 15, 1904	3.25	3.00	2.75	2.50	13.35	13.15
1905	Feb. 1, 1905	3.75	3.50	3.20	3.00	15.50	16.00
1906	Dec. 5, 1905	4.25	4.00	3.70	3.50	17.25	17.25
1907	Nov. 5, 1906	5.00	4.75	4.20	4.00	21.50	21.50
1908	June 15, 1908	4.50	4.25	3.70	3.50	16.00	15.00
1909	May 10, 1909	4.50	4.25	3.70	3.50	14.75	14.25
1910	Dec. 24, 1909	5.00	4.75	4.20	4.00	19.00	17.25
1911	Apr. 21, 1911	4.50	4.25	3.70	3.50	15.00	13.75
1912	Mar. 20, 1912	3.75	3.50	3.00	2.85	14.25	13.25
1913	Nov. 19, 1912	4.40	4.15	3.60	3.40	17.25	17.50
1914	May 1, 1914	3.75	3.50	3.00	2.85	14.00	13.25
1915	Apr. 19, 1915	3.75	3.45	3.00	2.80	13.60	12.75
1916	Dec. 7, 1915	4.50	4.20	3.75	3.55	18.50	18.00

Ore and Pig Iron

The accompanying chart, Fig. 1, shows the prices at which iron ore has sold during the 24 years beginning Dec. 15, 1889, together with the prevailing valley prices of bessemer and No. 2 foundry pig iron at the date at which the ore buying movement was at its height. The idea, which was first embodied in chart form in our issue of Feb. 21, 1907, is to establish in a graphic manner the relation of the raw material price to that of pig iron. During the past years up to 1909, barring some slight irregularities, the two series of lines

Table II.

TABLE SHOWING PERCENTAGES OF ADVANCES AND DECLINES IN ORE AND PIG IRON, 1903-1915

Year.	Old range Bessemer.	Advance or decline in price.	Advance or decline in per cent.	Bessemer pig iron Valley.	Advance or decline in price.	Advance or decline in per cent.
1903	$4.50	.....	.....	$21.50	.....	.....
1904	3.25	—$1.25	—27.8	13.35	—$8.15	—37.9
1905	3.75	+ .50	+1.54	15.50	+ 2.15	+16.1
1906	4.25	+ .50	+13.3	17.25	+ 1.75	+11.3
1907	5.00	+ .75	+17.6	21.50	+ 4.25	+24.6
1908	4.50	— .50	—10.0	16.00	— 5.50	—25.6
1909	4.50	.....	.....	14.75	— 1.25	— 7.8
1910	5.00	+ .50	+11.1	19.00	+ 4.25	+28.8
1911	4.50	— .50	—10.0	15.00	— 4.00	—21.1
1912	3.75	— .75	—16.7	14.25	— .75	— 5.0
1913	4.40	+ .65	+17.3	17.25	+ 3.00	+21.1
1914	3.75	— .65	—14.8	14.00	— 3.25	—18.8
1915	3.75	.....	.....	13.60	— .40	— 2.9
1916	4.50	+ .75	+20.0	18.50	+ 4.90	+36.0

approached nearly to being parallel, showing that ore prices have declined with the prices of iron. This was not true in 1909, when the lines representing pig iron prices had a downward tendency while those for iron ore prices continued straight. In 1910, when ore prices were fixed, the lines for both pig iron and ore had an upward tendency, but later, in 1910, pig iron started downward and continued to decline throughout the year, the decline in bessemer being $4.

At the time of the fixing of ore prices in April, 1911, and March, 1912, the downward tendency was common to both pig iron and iron ore, while at the time of the fixing of prices for 1913, the tendency of both pig iron and iron ore was upward. In May, 1914, lines for pig iron and iron ore were alike in tending downward, but in April, 1915, pig iron prices were lower than they were a year ago and the lines on the chart turn downward while the lines showing ore prices are straight. This year the lines showing pig iron prices advance sharply and the lines showing ore prices also show an upward trend, but not as decided as those which represent the prices of pig iron. In Table II is shown the rise and decline of old range bessemer ore and bessemer pig iron from 1903 to 1916. The advance of 20 per cent in the price of ore compares with an increase of 36 per cent in pig iron prices over last year. The gain in both pig iron and ore prices is the largest of any year shown in the table. In 1915, old range bessemer ore prices remained unchanged, while pig iron prices declined 2.9 per cent. In 1914, ore prices declined 14.8 per cent from the 1913 prices and pig iron fell off 18.8 per cent. In 1913, the advance in ore was 17.3 per cent and in pig iron 21.1 per cent.

The fluctuations of the four grades of Lake Superior ore according to the value of units of iron in the natural state is shown in Fig. 2. For the years preceding 1907, the guarantee of bessemer ores was 55.70 per cent natural and for the non-bessemer ores it was 52.80 per cent except Messabi non-bessemer for 1905 and 1906, when the natural iron content was 53 per cent. Before sales for delivery in 1907 were made, the natural iron content for the base was changed to 55 per cent

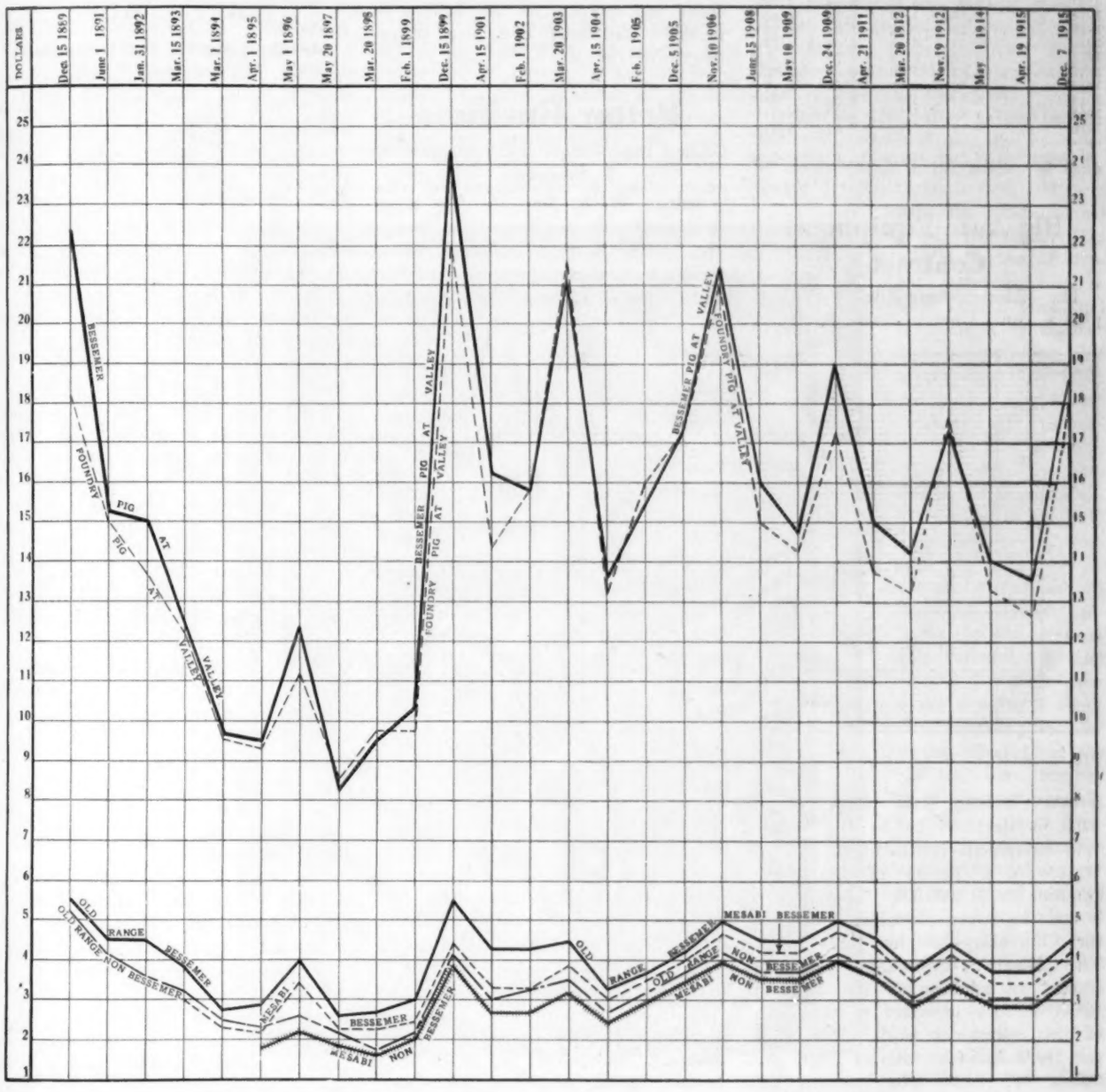


FIG. 1—FLUCTUATIONS OF PRICES OF IRON ORE AND PIG IRON, 1889-1916

for bessemer and 51.50 per cent for non-bessemer. The fluctuations in unit prices have been as follows:

VALUE OF UNIT OF IRON FOR 13 YEARS.

	Old Range.		—Mesabi.—	
	Bessemer, cents.	Non-Bessemer, cents.	Bessemer, cents.	Non-Bessemer, cents.
1903.....	7.94	6.82	7.05	6.06
1904.....	5.73	5.21	5.29	4.73
1905.....	6.61	6.06	6.17	5.66
1906.....	7.50	7.01	7.05	6.60
1907.....	9.09	8.16	8.64	7.77
1908.....	8.18	7.18	7.73	6.80
1909.....	8.18	7.18	7.73	6.80
1910.....	9.09	8.16	8.64	7.77
1911.....	8.18	7.18	7.73	6.80
1912.....	6.82	5.83	6.36	5.53
1913.....	8.00	6.99	7.55	6.60
1914.....	6.82	5.83	6.36	5.53
1915.....	6.82	5.83	6.27	5.44
1916.....	8.18	7.28	7.64	6.89

Fluctuations of iron ore prices expressed in values of units of iron in natural state.

Big Auto Equipment Contract

The Electric-Auto-Lite Co., with plants on Cherry and Mulberry streets, Toledo, last week closed what is declared to be the largest auto equipment contract ever placed. It covers a period of years and amounts to $19,000,000. The contract is for the entire electrical equipment for Chevrolet cars for three years. The Electric Auto-Lite Co. has started an addition to its Mulberry street factory in order to take care of this additional work. The addition will be four stories high and 380 x 105 feet. The concern will have, when the new building is completed, 400,000 square feet of floor space and will employ 3,500 people.

Is Compelled to Enlarge

The Acme Die Casting Corporation, with shops at Bush Terminal, Brooklyn, N. Y., which commenced business a year ago, with a capital stock of about $125,000, reports its business of late has been so heavy that for a time the company found it necessary to refuse orders. As a result, the capital has been increased to $200,000, more space has been taken and additional equipment installed. The Acme company manufactures die castings in the usual zinc, tin and lead alloys, using a new type of die-casting machine which embodies some novel features. It may be regulated automatically as to speed and temperature, as well as to pressure and only one man is required to run it.

Better Business

Gradual Improvement of Conditions in the Northwest

Seattle, Wash., Dec. 11.—The foundry, steel and machine shop people are finding some encouragement in the present outlook for business. The market has been such for some time that the purchaser could about set his own price while the price of pig iron has gone above $25. Heavy orders for lumber are sending the market up again, $2 per thousand having been added during the past 60 days. England, France and Russia are the sources of some of these orders. Scrap does not show very much change, although it is scarcer than it has been for some time. The more active demand for lumber has naturally stimulated the mills to a certain extent and they have been placing with the foundries and shops larger orders for equipment. This is contrary to the usual run of things, as it is not customary for them to do this during the last months of the year.

The situation is being helped by the railroads. The Alaskan Railway Commission is buying quite freely in the local market and all the railway companies are buying more or less. The Seattle Construction & Dry Dock Co. has three submarines partially finished and has just started construction of a destroyer for the government.

Several other large orders have also been received. The secretary of the Metal Trades Association reports a gradual improvement among the shops generally.

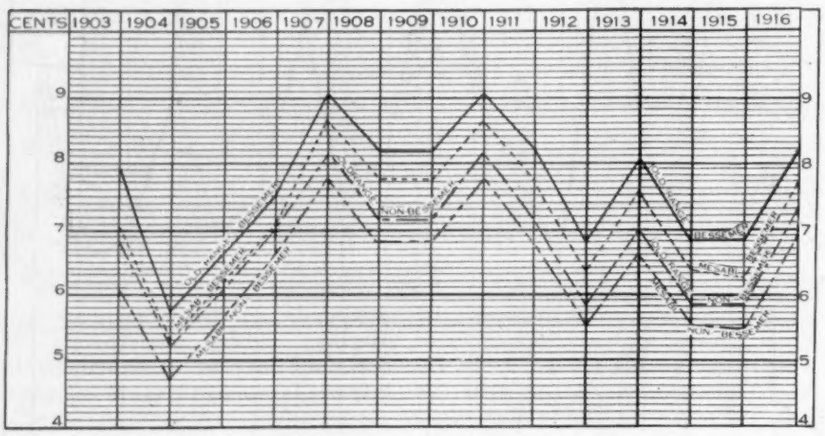


FIG. 2—RANGE OF LAKE SUPERIOR ORE PRICES BY UNITS OF IRON, NATURAL

Wage Clause

May Be Inserted in Shell Contracts in Canada

Toronto, Dec. 14.—Lionel Hichens and Hon. R. H. Brand, representatives of the British department of munitions, who have been in Ottawa for some time effecting the organization of the new imperial munitions board, left Ottawa this week for New York on their return trip to England. A delegation of labor men headed by J. C. Walters, president of the Canadian Trades and Labor Congress, arrived at Ottawa Dec. 9 to interview the government with the object of having a fair wage clause inserted in shell contracts. It is stated that there would be some difficulty in the way of this, as owing to the absence of any stipulation as to wages in contracts already let, if the fair wage clause were embodied in new contracts, workmen in the different factories would be employed under varying conditions. Hon. T. W. Crothers, minister of labor, and Chairman J. W. Flavelec, of the munitions committee, promised to deal with any complaints laid before them as to wages or factory conditions, and said that contractors who did not treat their men fairly would receive no further contracts. The question of inserting the fair wage clause would receive further consideration.

The shops of the National Transcontinental railway, at Transcona, Man., which were taken over together with the railway by the Canadian government, are now making shells for the British government. It was originally proposed that the work should be done by the government, but this plan was regarded as impracticable and it is in the hands of the Transcona Munitions Co., recently organized.

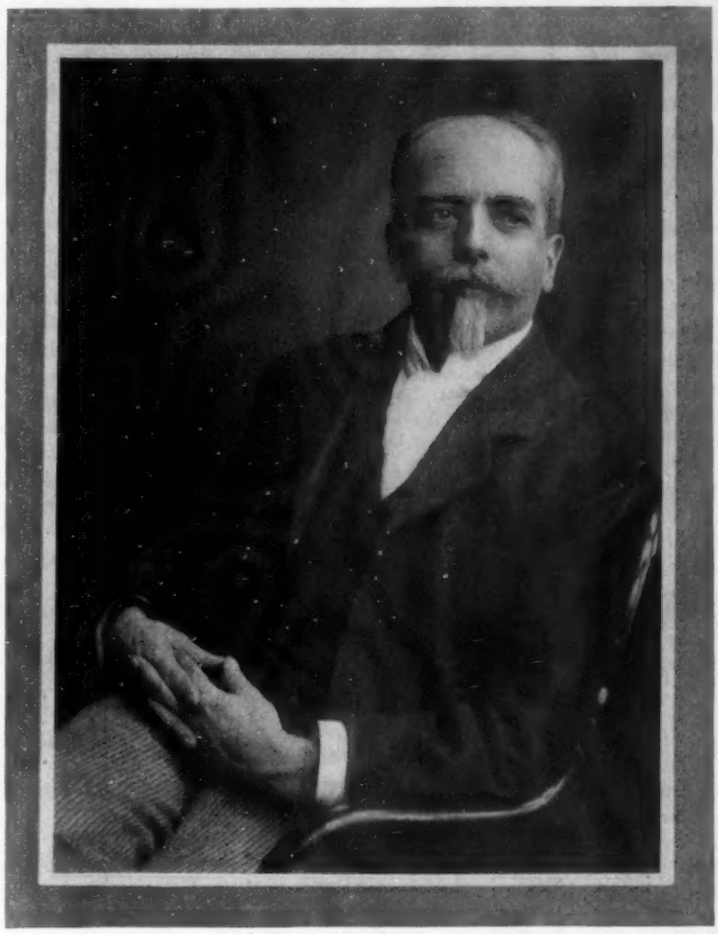
The Bridgeport Projectile Co., Bridgeport, Ct., which recently incorporated with an authorized capitalization of $10,000,000, has reduced the amount of its capital stock to $5,000,000, instead of $3,000,000 as it was fixed at one time. The new money being required is to be used to build a forge plant and a gun plant in which guns of heavier caliber are to be constructed.

James Mapes Dodge---Close of a Life of Great Usefulness

JAMES MAPES DODGE, chairman of the board of the Link Belt Co., died at his home in Philadelphia, Dec. 4, 1915. He was born June 30, 1852, at Waverly, N. J. His grandfather was Prof. James J. Mapes, a noted chemist and scientist, and his mother, Mary Mapes Dodge, a well-known author for many years editor of the *St. Nicholas Magazine*.

Mr. Dodge spent three years at Cornell university and a year at Rutgers. At the latter institution, he took a special course in chemistry under the late Prof. Geo. H. Cook, state geologist of New Jersey. After spending a short time at the Morgan Iron Works in New York City, he entered the shops of John Roach, ship builder, at Chester, Pa., where his marked mechanical ability and ingenuity brought him rapid advancement. During the three years at the Chester establishment, he was successively journeyman, foreman and superintendent of erection.

Shortly after the centennial exposition at Philadelphia, in 1876, he left the ship yard and after several years of experience in the east, went to Chicago. It was there he formed the acquaintance of William D. Ewart, inventor of Ewart link-belting, and soon afterward he joined hands with Mr. Ewart and his associates in the development of the chain business.



JAMES MAPES DODGE

At that time, about 35 years ago, the application of chains to power transmission was exceedingly limited, and their use in elevating and conveying machinery was practically unknown. The Ewart chain blazed the way for a new industry, and Mr. Dodge and his associates were quick to seize the opportunity. Mr. Dodge's early work was confined principally to development and manufacture, and here his genius had full play. New chains, new methods of manufacture, and new conveying and elevating appliances were brought out in rapid succession.

After this period of development, Mr. Dodge went east and entered the partnership of Burr & Dodge, of Philadelphia, for the exploitation of the Ewart chain and its allied interests. Out of this partnership grew the Link-Belt Engineering Co., in 1888, and after the organization of this company, Mr. Dodge carried out his idea of development along strictly engineering lines. A highly specialized engineering staff was developed, a scientific study was made of the characteristics of the materials to be handled, and special appliances were invented to meet varying conditions.

Machines grew from capacities of 30 tons per hour to capacities of 600 tons per hour, and from simple problems solved by detached machines, the company expanded its field to the planning and arranging of works to secure the most economical and efficient handling of both raw and finished product under guarantees of accomplishment. In all this development, Mr. Dodge was the creative and guiding spirit.

It was in 1889, after having become thoroughly acquinted with the needs of the anthracite coal industry, that Mr. Dodge developed the boldest and perhaps the most original of his inventions. This was his system of storing anthracite coal in large conical piles, and reloading it by machinery, accomplishing this result with little labor and practically no breakage. The invention was so complete, and yet withal so simple, that it is still without a rival in the field of anthracite coal storage.

When it is considered that this system reduced the cost of storing coal from 30 and often 40 cents per round trip, to 5 cents, it is evident that the saving affected on the 5,000,000 tons handled by this system annually has been a large item.

Fertility of invention and mechanical ingenuity are rarely coupled with a high order of executive ability, yet such is the combination of qualities that brought success to Mr. Dodge. As an inventor, he had the distinction of being mentioned in patent office reports among the few who had been granted over one hundred letters patent, and as an executive he had won success as the president and active managing spirit of such highly successful industrial engineering corporations as the Link-Belt Engineering Co. and the Dodge Coal Storage Co., later called the J. M. Dodge Co. He was made president of these companies in 1892, and chairman of the board of the

Link-Belt Co., when it was organized in 1906 as a merger of the allied companies, the Link-Belt Engineering Co., Philadelphia; the Link-Belt Machinery Co., Chicago, and the Ewart Mfg. Co., Indianapolis, at which time Charles Piez became president of the Link-Belt Co.

Among Mr. Dodge's important inventions and improvements were those relating to the construction and manufacture of the Link-Belt silent chain, its bushed joint being the most essential element in the durability and efficiency of the chain.

Though for many years a large employer of men, Mr. Dodge had never met with any strikes or other labor difficulties. He was deeply interested in the personal welfare and advancement of his employes, and a conspicuous leader in the general introduction of the best elements in "scientific management", having the double purpose of producing greater efficiency in the mechanical and human equipment and greater pay with fewer hours and improved conditions for the men. He was closely associated with Frederick W. Taylor in the accomplishment of remarkable results for the benefit of both employers and employes, in a wide circle of industries. His influence was always toward the development of self-help, initiative, ambition and responsibility in the men and of a spirit of fair play and humanitarianism as real business assets in the many employers who recognized Mr. Dodge's leadership in modern progressive methods of shop management.

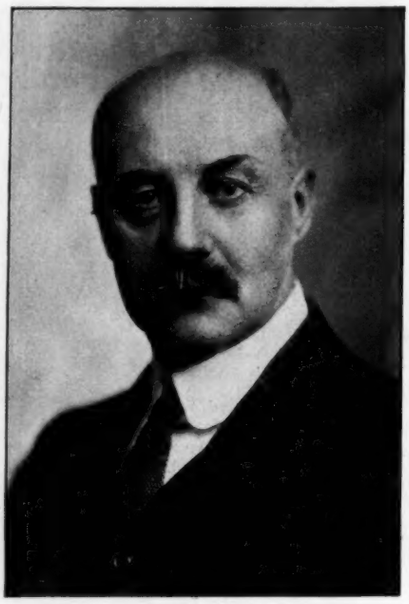
Always affirmative in his views, he was fertile in suggestion, and quicker to point out the better way, or the way to improve, than to condemn or discountenance. He was encouraging, optimistic, and a constant inspiration to those with whom he came in contact, public spirited and a leader in various societies and clubs of which he was a member, such as the American Society of Mechanical Engineers, of which he was at one time president, American Academy of Fine Arts, Franklin Institute, Union League Club, New England Society, Engineers' Club and others.

Resolutions eulogizing the life and work especially that for the promotion of public affairs in the city of Philadelphia, of Mr. Dodge have been adopted by the Committee of One Hundred and by other civic organizations of that city during the past week. Mr. Dodge was regarded as one of the leading citizens of Philadelphia in his devotion to the highest ideals of citizenship as he had given his time freely and vigorously to the betterment of matters of public concern.

Death of Richard Henry Lee

Richard Henry Lee, aged 56 years, superintendent of the Lebanon blast furnaces of the Pennsylvania Steel Co., and consulting engineer of the American Manganese Mfg. Co., died suddenly Dec. 8, of heart failure.

Mr. Lee had been actively connected with blast furnace management at many places in this country since 1879, when, on leaving Lehigh University, his father put him in charge of the cold blast charcoal furnaces of the Logan Iron & Steel Co., at Burnham and Greenwood Furnace, Pa. He had occupied the following positions during the past 37 years: Logan Iron & Steel Co., 1879-1884, blast furnace superintendent; 1884-1891, assistant general superintendent;



RICHARD HENRY LEE

1891 - 1898, general superintendent; Colorado Fuel & Iron Co., 1898-1899, blast furnace superintendent; 1899-1903, assistant general superintendent; Tennessee Iron, Coal & Railroad Co., 1903, superintendent Middlebrough Furnaces, Kentucky; Alabama Steel & Wire Co., 1904, Superintendent Gadsden furnace; Lackawanna Steel Co., 1904-1905, assistant superintendent Buffalo furnace; Shenandoah Iron Co., 1905-1906, superintendent Liberty furnace; Pennsylvania Steel Co., 1906-1915, superintendent Lebanon furnaces; American Manganese Mfg. Co., 1914-1915, consulting engineer and metallurgist Dunbar furnace.

Mr. Lee was a close student of the literature of blast furnace practice in this country and abroad, and a fearless and systematic experimenter, and was rewarded, by his industry, by successfully solving many problems in the manufacture of pig iron, spiegeleisen, ferro-manganese, etc. He was unusually quick in meeting the emergencies and minor accidents which so often occur in the operation of blast furnaces, and took keen delight in overcoming such obstacles and in assisting other men in similar troubles.

He was noted for his kindness and generosity in freely giving to men, both younger and older than himself, the benefit of his technical knowledge and practical experience in blast furnace practice. Throughout life, he never deviated from his policy of helping others rather than himself, although he realized he was thus sometimes imposed upon.

In every position he occupied, he made many warm friends among his employers, associates, and the workmen with whom he was brought into intimate contact.

In 1894, he was married to Catherine M. Shaeffer, and is survived by his wife and son Richard Henry Lee, aged 20 years, now a student at Lehigh University.

Mr. Lee was a descendant of Richard Lee, prominent in Colonial times, being a descendant in direct line of Richard Henry Lee, signer of the Declaration of Independence.

He was a member of the American Institute of Mining Engineers, the American Iron and Steel Institute, and the Engineers' Society of Western Pennsylvania. His chief contributions appear in the Transactions of the American Institute of Mining Engineers for 1886, 1906, 1912 and 1913, although he was an occasional contributor to the discussion of the papers of others, and author of several important articles in the technical press.

Obituaries

William A. Conner, vice president and general manager of the Standard Underground Cable Co., Perth Amboy, N. J., died suddenly in his office on Dec. 7.

Wilfred R. Dean, 68 years old, one of the pioneer manufacturers of Indianapolis, and vice president of the Dean Bros.' Pump Works, died at his home late last week after a prolonged illness. The company, of which he was an officer, was founded in 1870, when he went to Indianapolis.

Grand Rapids Foundry Co., Grand Rapids, Mich., has increased its capital stock from $50,000 to $75,000.

Bonner Drop Forge Co., Danville, Ill., has increased its capital stock from $5,000 to $750,000.

Business News of Nation's Capital

President Expected to Discuss the Tariff Later—Merchant Marine, Government Ownership and Other Subjects Treated in Bills

Bureau of *The Iron Trade Review*,
206 Corcoran building,
Washington, Dec. 15, 1915.

TAKEN in connection with the inference given in his address before congress last Tuesday, informal remarks credited to President Wilson at the White House reception which he gave for members of the national Democratic committee last week are believed to indicate that the administration appreciates that the tariff is going to be a vital issue during the presidential campaign next year. Mr. Wilson's address left the impression that he would discuss the subject later in the session with congress and his remark said to have been made to the members of the committee implied that, in his estimation, the Republican party would have nothing other than the tariff out of which they could find campaign material.

Nothing has developed to show that the Wilson administration will propose an upward revision of the tariff, but it is certain that some officials of the administration are desirous that legislation be enacted to prevent dumping of foreign goods on the American market. It is known, as predicted heretofore, that recommendations will be made to congress to this end. A bill to prevent dumping is now under way of preparation in one of the departments.

Merchant Marine

On the question of merchant marine legislation, the administration is pushing its plans for reintroduction of the government ship purchase bill, which was defeated at the last session of the sixty-third congress through a filibuster in the senate. Conferences were held the latter part of last week between Secretary McAdoo, of the treasury department, Secretary Redfield, of the department of commerce, Senators Fletcher, of the Commerce Committee and Simmons, chairman of the finance committee; Representative Alexander, chairman of the committee on merchant marine and fisheries, and Solicitor Thurman, of the department of commerce. Discussion was given to details of the bill, now known as a naval auxiliary measure, and consideration has been given to the postponement of its introduction until some time in January. Moreover, it has been stated that supporters of the measure who favored tacking it on the naval appropriation bill as a rider have abandoned that project and will introduce it as a separate bill. Because it has been labeled a naval auxiliary bill, it is claimed that Senator Clarke, chairman of committee on commerce, and president pro tempore of the senate, will support the bill at this session. He was one of the leading Democratic bolters who opposed it at last session. The administration appears to be confident that the measure will pass the senate, which has an increased Democratic majority at this session, but apparently has considerable apprehension as to its chances in the house, where the Democratic majority is reduced to 25, cutting the balance of power down to 13. This gives a narrow margin and indicates a rough course for the bill in that body if anything like a determined revolt on the Democratic side sets in, as some think is probable. As proposed cloture in the senate was defeated, power of filibuster still exists there also.

Vexatious problems being faced with regard to the shipping bill relate to the way of manning the vessels, the prevailing sentiment seemingly favoring the plan that the entire crews be made up of Americans, inasmuch as the vessels would be naval auxiliaries. This, however, would make the cost of operation much higher than that paid for operating foreign vessels. This point will be gone into more thoroughly at a conference to be held this week. The proposed shipping board, to be constituted of cabinet members, would be given authority to regulate rates of American ships, and in order to control rates of foreign ships plying to and from United States ports, the board would require owners to obtain revocable licenses from it, another subject filled with many obstacles. The National Foreign Trade Council, in proposals it has just announced as to the upbuilding of an American merchant marine, is strongly opposed to government ownership, and, while it favors the creation of a shipping board, it would be constituted of practical marine men, who are not associated in any way with a political party.

Government ownership of an armor plate plant and a projectile plant, as advocated incessantly by Secretary of the Navy Daniels, is being given an impetus by supporters of the plan. The secretary has recommended both projects in his annual report. Senator Tillman, chairman of the committee on naval affairs, has introduced the bill drawn up by Rear Admiral Strauss proposing a government armor plate plant, estimated to cost $11,000,000. Senator Tillman favors having the proposed plant built at League island, Philadelphia, where the government owns considerable ground, but selection of the site is left by the bill to the navy department. The usual grist of bills favoring such a plant has also been introduced, members submitting them taking pains to suggest that it be built in their districts or states.

Immigration Bills

Proposed immigration has already made its appearance in the present congress, as had been anticipated, and in the manner predicted. The bill vetoed by President Wilson in the last congress, and also by Presidents Cleveland and Taft during preceeding congresses has been reintroduced by Chairman Burnett of the house committee on immigration. Mr. Burnett professes to have confidence that the bill will be enacted at this session. The President's attack on hyphenated citizens in his address to congress will, in the estimation of Mr. Burnett, work up a strong sentiment in congress against what he calls the indiscriminate admission of aliens and for a heavy barrier against foreigners of a certain type. Mr. Burnett thinks the bill would have passed over the President's veto in the last house except that a handful of "lame ducks" changed their votes at the last moment. An immigration bill has also been introduced by Senator Dillingham, of Vermont, chairman of the former immigration commission. His measure provides that male aliens over 16 years of age who cannot read should be excluded from the United States. The bill limits the admission in a year of any nationality to 10 per cent of the residents of that nationality. Unlike the bills vetoed by Presidents Cleveland, Taft and Wilson, the Dillingham bill proposes that the literacy test should be applicable only to males. Senator Gallinger and Minority

Leader Mann, of the house, who conferred last week with the President with regard to the administration's preparedness program, were promised by the President that it would not be made a partisan issue. Both minority leaders said that, if it were left non-partisan, they would support the general plan of the program, although, of course they reserved the right to object to details. It is claimed that the reported plan to tack the ship purchase bill on the naval appropriation bill was abandoned because of the fear that it would be held to be a partisan act, and therefore result in strong opposition and perhaps defeat of the preparedness program.

Pacific Rates

Washington, Dec. 15. — The interstate commerce commission is expected to make immediate appeal to the Supreme court, asking it to set aside the injunction recently granted by the special court of California against the order of the commission permitting trans-continental railroads to put into effect on July 15, 1915, Schedule C rates to Pacific coast terminals. This is the schedule which involves rates on iron and steel exclusively and is embodied in the commission opinion in the intermountain case. The pending application of railroads to establish a rate of 55 cents per 100 pounds on iron and steel articles from Pittsburgh to Pacific coast terminals would also be classified under this schedule, if the commission granted the application, an action which would let the railroads put that rate into effect without regard to rates to intermediate points.

Government Monopoly

Washington, Dec. 15.—Among others in congress who have made manufacturers of materials used by the army and navy their target of attack in congress is Senator Cummins, Republican, of Iowa. Shortly after Senator Tillman, Democrat, of South Carolina, had introduced in the senate the administration bill for a government owned "factory" to make armor plate and any "other material for the navy"—probably projectiles — Senator Cummins introduced an even more sweeping resolution. The resolution would, in a word, put private makers of such material out of business.

It asks for the appointment of a committee of five senators to make an investigation for the purpose of determining the "most feasible plan of acquiring or constructing manufacturing plants of sufficient capacity to supply the army and navy with all arms, armament and munitions of war, including the ships and their equipment".

No Corporation Rebates

Washington, Dec. 15.—David Lamar, "Wolf of Wall street", and other members of the so-called Anti-Trust League, who gained much desired publicity early last year after they had jockeyed the senate into passing a resolution asking for an inquiry by the interstate commerce commission to learn if the United States Steel Corporation had been receiving rebates have been given a cold turn down. The commission, acting upon the resolution passed by an unsophisticated senate, made its report to that body last Friday. Claims made by Lamar and his colleagues are almost contemptuously referred to by the commission, which says it "has reason to believe there is no basis for the allegation that wholesale rebates have been paid to the Steel Corporation during the period of six years mentioned in the resolution".

The commission further says that "apparently in alleging that 'offsets' and rebates have been received by the Steel Corporation during that period, the witnesses mentioned had in mind the dividends on the stock of the numerous subsidiary railroad and steamship lines owned by it, and as to this all the facts have been ascertained and are accessible in the various public records just mentioned. Under these circumstances, we venture to believe that the resolution of the senate is sufficiently complied with for all practical purposes by the reference to those investigations in connection with the foregoing statement".

The prime movers back of the resolution, aside from Lamar, were Henry B. Martin, president, and Herman F. Schulteis, attorney, and William H. Green, a member, of the so-called Anti-Trust League.

To Prevent Dumping

Washington, Dec. 15. — Chairman Kitchin, of the committee on ways and means, has been given a draft of a bill by Secretary of Commerce Redfield designed to prevent dumping of foreign goods in American markets at prices less than those at which the goods are sold in the countries of production. The bill follows the general lines of suggested legislation proposed by Secretary Redfield in a letter he sent some time ago to Dr. E. E. Pratt, chief of the bureau of foreign and domestic commerce. The bill, however, is somewhat more specific than suggestions Mr. Redfield made in that letter. One aim of the bill is to build up the dyestuffs industry in this country because it is so drawn that it is intended to prevent destruction of industries built up in the United States as the result of conditions growing out of the European war. President Wilson has not given his approval of the measure, it is understood, but may do so later. Mr. Redfield would make dumping an "unfair trade practice", forbidden by the Clayton act, and enforceable by the federal trade commission. Consular agents of the United States would be requested to gather facts as to the market price of goods and report to custom collectors.

Battleship Materials

Washington, Dec. 15. — Secretary Daniels last Saturday announced the award of contracts covering the structural steel material required for the two battleships authorized by the last session of congress. These ships are to be built at the New York and Mare Island yards in accordance with the recent decision of the secretary after comparing the estimates submitted by the yards with the bids submitted by various shipbuilding concerns. The awards were as follows:

Pounds.		
51,882,300	to Carnegie Steel Co..	$1,680,777.70
9,611,720	to Carbon Steel Co...	537,295.15
3,593,800	to Pbgh. Screw & Bolt	105,708.90
228,000	to H. A. Wagner.....	25,365.00
1,836,800	to Am. Steel Foundries	110,208.00
67,152,620		$2,459,354.75

This material represents the amount required for two ships, making the cost for structural steel for one ship amount to $1,229,677.38, as compared with $994,114.19, the cost of similar material for the CALIFORNIA, the last ship authorized for construction at a navy yard.

Awards were made in each instance to the lowest bidder. The Carnegie company was the lowest on all material except nickel steel, which went to the Carbon company; two classes of rivets, awarded to the Pittsburgh Screw & Bolt Co. and H. A. Wagner, and castings, given to the American Steel Foundries. The Carnegie company was also lowest on all of the approximately 17,000 tons of armor plate required for both vessels. Award of the latter material probably will be made soon.

C. K. Turner & Son, 116 Broad street, New York City, are in the market for 50 tons of twisted steel bars for reinforcing of ⅜ to 1-inch sizes. This requirement is for export.

Cost of Accidents Greatly Reduced

By Methods Adopted at Some Plants and Discussed at Meeting of American Society of Mechanical Engineers

MACHINE shop practice and industrial safety furnished the topics for important papers which were presented at the thirty-sixth annual meeting of the American Society of Mechanical Engineers, held Dec. 7 to 10, at the Engineering Societies building, New York. In addition, there was a large number of papers on railroad, steam engineering, textile and miscellaneous subjects. The session on machine shop practice was the occasion for the presentation of further valuable data on automatic machine tools, papers being read by Luther D. Burlingame, Conrad M. Conradson and L. C. Brooks which dealt with the design, attachments, operation and control of automatic machines, particularly lathes and screw machines.

The report of the council showed that the society has been adding new members in record-breaking fashion. The total membership on Oct. 31 was 6,577, a net increase during the year of 587. On account of the unusual conditions prevailing abroad and the inability to communicate with members there, foreign engineers who are members of the society have been continued on the rolls. The annual report of the finance committee showed that the society is doing a business of approximately $150,000 a year and that it discounts all its bills. The society's life membership fund, which amounts to $44,120.11, has been invested separately, as have all other trust funds. From the earnings of these funds, at a rate of $6,000 per year, the society is retiring the certificates of indebtedness for the land on which its headquarters is located. To offset the $54,100 of certificates of indebtedness, $40,268.90 thus has been accumulated. In addition, there is approximately $40,000 cash on hand. This report showed the society to be, financially, one of the strongest engineering societies in the world.

Constitutional Revision

Among the features of the business session on Wednesday morning was the report of the committee on constitution and bylaws on matters referred to it from the council, covering certain revisions. One of the proposed revisions provided that in addition to the nominations made by the regular nominating committee consisting of five members appointed by the president, nominations hereafter also may be received when presented by a special nominating committee, to consist of any group forming one or more per cent of the members entitled to vote. This provision was formulated to replace that providing that a special nominating committee shall consist of 20 or more members. The latter proposal aroused a great deal of discussion, several speakers contending that any amendments to the constitution should come from the membership of the society and should not emanate from, nor originally receive the attention of the council. John C. Parker of the Parker Boiler Co., Philadelphia, contended that the present method of electing officers and vesting them with authority is such as to make it impossible for individual members to secure a fair hearing. A growing spirit of commercialism, he claimed, is reflected in the activities of the society and he denounced particularly the recent work of the boiler specifications committee, which, he contended, formulated specifications to govern the construction, operation and inspection of boilers which are highly unfair to some of the concerns vitally interested in a code of this nature. Mr. Parker read extracts from numerous letters he received, which reflected considerable dissatisfaction with the conduct of the society and especially with the conduct of the boiler specifications committee, these letters, in numerous cases, citing the names of individuals.

Mr. Parker several times was warned by the chair not to indulge in personalities and his remarks finally, by a vote which was practically unanimous, were declared out of order. The discussion of the revision of the constitution in regard to special nominating committees, terminated in a vote to postponed action on the proposed revision.

Another proposed amendment provided that the society shall claim the exclusive copyright to reports of its duly appointed committees and on all papers read before the society, council to permit the reprinting of all reports and papers on condition that due credit be acknowledged to the society and the author. The purpose of this proposed amendment was to secure the widest possible circulation of the proceedings of the society with a view to making the work of the society known, encouraging engineering progress and extending the professional reputation of its members. The discussion brought out an objection to the effect that some provision should be made to permit the authors of papers presented before the society to reprint such papers for inclusion in their published works without runnning any danger of infringing on the copyright.

Tributes to Taylor

Following the business session, an hour was set aside as a memorial to the late Frederick W. Taylor, president of the society in 1906, who died at Philadelphia last March. An able address on the career of Mr. Taylor was presented by Henry R. Towne. A feature of Mr. Taylor's career, said Mr. Towne, was that he spoke only when he had a message. His first paper, on the subject of Management, was written only after he had conducted investigations along the lines of his ideas for a period of 15 years, while his classic paper on "The Art of Cutting Metals" was presented only after an investigation covering more than 20 years. The Taylor system Mr. Towne defined as a new science which others had glimpsed but which Taylor grasped and brought into form. This system, he said, is not functional management, routing, motion study, time study, etc., but is a co-ordination of all of them. Taylor, he said, saw the iniquity of the old piecework system by which increased output and efficiency generally were punished by a reduction in the rate of piece work compensation. By the Taylor system, Mr. Towne said, the $2 man of today may become the $3 man of tomorrow, not by sweating but through the application of intelligence.

H. L. Gantt also contributed an eloquent testimonial to the indomitable spirit with which Taylor pursued his work and to the brilliant manner in which he successfully carried out many daring engineering conceptions, such as the construction and design along absolutely new lines of a huge forging hammer at the Midvale Steel Co.'s plant.

Rear Admiral Goodrich, who also spoke in tribute to Mr. Taylor, recounted his early experiences as commandant of the Brooklyn Navy yard, describing the spirit of inefficiency which generally characterized the navy yards a number of years ago. It was largely because of the advice given by

Mr. Taylor, said Rear Admiral Goodrich, that he had the courage to institute many radical changes in the management of the navy yard which since have increased greatly the efficiency and economy of operations at that big plant.

Machine Tool Motors

L. C. Brooks, of the General Electric Co., Schenectady, N. Y., submitted a paper entitled "Electric Operation and Automatic Electric Control" for machine tools. In the early application of electric motors to machine tools, Mr. Brooks stated, the motors were started by hand-starters. While in some cases the use of hand-starters still is preferable, the time has been reached when automatic starters, remote controlled, are the most suitable. One of the advantages of automatic control is that the operating switch is easily attached to the machine and the main panel may be located at a distant point. Another advantage is that the starting time of the machines may be regulated automatically to suit the load conditions of the motor. Still another advantage is that accurate stopping points may be obtained by dynamic braking. The author described the three general types of automatic starters and enumerated the various safeguards which should be used in connection with them. At the present time, Mr. Brooks said, the problem of purely automatic control for general lathes has not been entirely solved, although lathes for a special class of work have been controlled with safety and efficiency. Automatic control equipment also has been applied to boring mills, planers and slotters. An important factor in the successful operation of an electrically-controlled machine is the motor. For small printing presses, ventilating fans, small machine tools, woodworking machines, etc., the shunt motor is applicable and for adjustable speed work it is suitable for planers, boring mills, heavy lathes, etc. The series motor always should have a certain friction load and is thus applicable to centrifugal pumps, cranes and hoists.

The discussion of Mr. Brooks' paper, which was opened by H. F. Stratton of the Electric Controller & Mfg. Co., Cleveland, centered mostly on the relative merits of automatic dynamic control and the drum controller. The purpose of the automatic machine tool controller, Mr. Stratton said, is to increase production and it does this by protecting the motor and thus saving delays; by providing stopping by dynamic braking, thus transmuting unproductive time into productive effort; and by enabling the workman to do more work through relieving him of much mental and physical effort. In addition to the limitations of manual acceleration, one of the vital objections to the drum controller, said he, is that heavy and damaging regenerative currents develop when the drum controller is moved from a position of relatively high speed to the off-position. In connection with Mr. Brooks' intimation that the automatic controller is not satisfactory for lathes, Mr. Stratton expressed the belief that more lathes are equipped with automatic controllers than all other machine tools combined. Several of the fastest-working machine shops in the country, he said, use such controllers on lathes. The R. B. LeBlonde Machine Tool Co., Cincinnati, for instance, he said, found as a result of tests that it was able to produce 20 per cent more work on heavy duty lathes equipped with automatic dynamic controllers than with the ordinary motor-driven lathes.

H. D. James, of the Westinghouse Electric & Mfg. Co., discussed Mr. Brooks' paper at length, contending in effect that the electrical equipment for both motor and controller, used in connection with machine tools, is being reduced in complication and gives increased durability. The controller, he said, should be selected with respect to the motor used, as some types of motors require more refinement in control apparatus than others. The size of a motor and controller, Mr. James stated, is an important item and the number of parts of the controller should be reduced as far as safety will permit.

Mr. Burlingame's Paper

A companion paper to that on "Electric Control of Machine Tools," by L. C. Brooks and to that on Automatics, presented by Ralph L. Flanders, before the International Engineering Congress in San Francisco last September, was one entitled "Automatic Mechanical Control of Lathes and Screw Machines," read by Luther D. Burlingame, Providence, R. I. In a general way, stated the author, the term "automatic control" now applies to the organization of a machine so that all operations required to complete the work are automatically controlled, the object being to have these operations so performed as not only to secure in large measure the advantages of hand work, guided by human intelligence, but also to insure a uniformity and quantity of product beyond that which can be obtained commercially by hand work. The vital question in determining on the employment of automatically controlled machines is whether the product is wanted in sufficiently large quantities and whether the design is sufficiently well established to justify the investments in such special machines and in arriving at this determination, the added original cost and the greater cost for repairs as well as the necessity for highly skilled supervision of the operation of such machines, must be taken into consideration. Mr. Burlingame's paper supplemented that of Mr. Flanders by illustrating with specific cases, the general principles and organization of devices for automatic mechanical control. He described at length the features most prominent and essential in the automatic control of machine tools under the following classification: Spindle drives, means for inserting and removing the work, feed mechanisms and indexing mechanisms, and means of control for the various mechanisms.

Fluid Pressure Control

An exceedingly interesting paper which was accepted as a separate contribution during the discussion on Mr. Brooks' paper, was that on "Hydraulic and Pneumatic Control for Machine Tools," by Conrad M. Conradson, Eau Claire, Wis. This paper contained a complete exposition of the subject of fluid pressure control, which has been of growing interest to designing engineers the past few years. After discussing the extensive employment of hydraulic and pneumatic control in elevator installations, guns of large calibre, etc., the author treated the application of this method of control to machine tools. The chief method of applying hydraulic control, he said, is by means of a cylinder and piston, the one being attached to the stationary member and the other to the moving member of the machine tool, the relative motion of the cylinder piston being controlled by suitable valve mechanisms which are actuated either automatically or by hand. Mr. Conradson summarized the various applications of this method of control as follows:

1—A hydraulic or pneumatic mechanism may be used for actuating the rotary spindles of machine tools. This use has been of limited scope and requires considerable further development before it proves successful.

2—The hydraulic mechanism may be employed to actuate reciprocating machine tools directly by means of the cylinder and piston, one being attached to the tool-holding member and the other to the work-carrying member. In some cases, gears or levers may be interposed between the hydraulic unit and the members of the machine tool. This kind of installation is advantageous in the case of planers, slotters, broaching machines, etc.

3—The hydraulic mechanism may be

employed for effecting the feed of machine tools directly as in the turret lathe, drilling machine, gun tube boring machine, etc., or indirectly as in wheel lathes, pit lathes, etc. In machine tools of the former classification, the cylinder and piston are connected directly to the frame and the spindle-carrier of the machine. In the latter class of tools the piston may be connected to a pawl actuating the ratchet on the feed screw.

4—Hydraulic and pneumatic mechanisms may be employed to actuate the various members of the machine tool, such as the work-carrier and the tool-carrier in an automatic lathe, the lock-bolt in indexing the mechanisms, etc., and for clamping the members of a machine firmly when in operative condition, as, for example, clamping a turret to its slide after indexing.

5—Hydraulic mechanisms may be employed advantageously for work in jigs, for clamping fixtures to machine frames, etc.

Mr. Conradson's paper described in detail a number of typical applications of hydraulic and pneumatic mechanisms to machine tools. He described a multiple spindle automatic lathe which he recently invented, saying this is the most complete example of a fluid-pressure-controlled machine so far developed. Mr. Conradson expressed the belief that the adoption of the principle of fluid pressure control will be greatly extended, especially for actuating semi-automatic and automatic machine tools, reciprocating machine tools and for chucking. Fluid pressure control, he said, can be relied upon by the designer as at least as safe as mechanical control.

H. K. Hathaway, in discussing automatic control, pointed out that, compared with certain lines of special machinery, the art of controlling the operations of machine tools is, as yet, practically undeveloped. In the textile industries, for instance, said Mr. Hathaway, the machines in use are controlled to such a high degree that they stop automatically whenever any detail of operation goes wrong. Much work remains to be done, he said, in providing automatic stops for safeguarding the operation of machine tools of all kinds.

Proposed Safety Code

A feature of the session of the machine shop section was the report by Luther D. Burlingame, as chairman of the committee on machine shop practice, embodying a proposed safety code for the use and care of abrasive wheels. This code originally was recommended in 1914 by a committee of the National Machine Tool Builders' Association and later was subjected to slight changes by the Abrasive Wheel Manufacturers, who, in turn, submitted it to the American Society of Mechanical Engineers. The code, as further changed in some minor respects by the committee on machine shop practice, was tendered for acceptance by the council of the society.

Carl M. Hansen, in a paper entitled "Standardization of Safety Principles", contended that responsibility for the hazards in the various industries should be accepted squarely by the engineers. Safety, he contended, is not a question of law and he mentioned many cases to prove that safety legislation, such as statutes which provide that it is unlawful for an elevator operator to start his car until the doors of the shaft are closed and latched, does not prove practical. In standardizing safety principles, Mr. Hansen said, it is necessary that the standards adopted be sufficiently high to afford all possible safety to life, limb and body from accident and fire hazards; such standards must be comprehensive, embodying not only the building and its equipment, but all plants regardless of location; they must be of a practical character in order not to destroy or distort the convenience or efficiency of the equipment to which they are applied; they must be simple, to the end that the safest way always will be the easiest way; they must be positive in order that they may be depended upon for unfailing action with as little consideration as possible for uncertain human factors, such as knowledge, memory and involuntary acts. Mr. Hansen discussed typical factory buildings and equipments with a view to illustrating the actual application of such standardized safety principles, taking especial care to include commonly existant types of buildings, and methods of application of safety principles which might be affected without undue expense or interference with manufacturing operations. In regard to equipment, Mr. Hansen declared that where machine tools are to be used, only those should be specified which have all possible safeguards embodied in original design; in order to meet the principle of safety, a safeguard for a machine should be so constructed as to prevent the removal or misuse of its essential parts and a further effort should be made to obtain machines so designed that they cannot be operated unless the guard is in position. He condemned the use of phases, such as "can easily be removed", often noted in advertisements of certain guards. A real argument for superiority of a safety appliance is that the appliance "can not be removed". In a paper entitled "The Modern Movement for Safety from the Standpoint of the Manufacturer", Melville W. Mix, president of the Dodge Mfg. Co., Mishawaka, Ind., contended that no manufacturer will make real progress with the modern safety movement until he takes a personal interest in it and is able to transfer his enthusiasm and earnestness to those directly in charge of the work and through them, in turn, to the workers themselves. The market, said Mr. Mix, offers guards of all kinds for all sorts of protecting purposes and places, but experience has developed that their use is not especially effective without co-operation of the workmen. The Dodge Mfg. Co., he stated, found that through the interest in the safety movement which it stimulated among its men, the total cost of accidents for each $100 of the annual payroll, including the cost of first-aid, hospital bills and claims, was reduced from 53 cents in 1910 to 7 cents in 1914. As a result of the interest of the men the company also found that the time lost through accidents was greatly decreased. A wage bonus of $2 extra pay for all men in a department having a perfect score for one year, was based upon the general effect of a cash bonus, and more particularly on the fact that a man will do for the benefit of the gang or department what he would consider beneath his dignity to do to safeguard himself against minor accidents.

Attitude of Employer

W. H. Cameron submitted a paper, discussing the attitude of the employer toward accident prevention and workmen's compensation. Many employers, he said, are not yet in sympathy with the accident prevention problem. He also stated that the workmen's compensation laws are defective in many ways. He believed, however, that both employer and employe will profit by the work of the National Safety Council, which, within a period of two years since its establishment, has secured a membership of 1,600 employers who are formulating information to promote accident prevention.

W. P. Barba, Philadelphia, in a paper on "Industrial Safety and Principles of Management", said it is probable that a study of the hiring of men would reveal the fact that an investment of $150 is necessary before a newly-employed man becomes productive. When true principles of management are but little understood and are taught rarely, it is customary to witness many discharges as corrective of offenses which are trivial. These discharges, in any case, act only as correctives for the benefit of the employer with whom the discharged workman next may engage

for employment. The better way is to use means of punishing and correcting offenses which shall inure to the benefit of the employer as well as of the employe. This punishment can be affected by lay-off or fine; discharge should be rare and only for major offenses. Mr. Barba advised that such fines should involve relatively small sums and that in no case should the fines accrue to the benefit of the company. Such fines, he said, should be converted into a fund for the benefit of the whole body of workers. The speaker denied emphatically the contention that the establishment of workmen's compensation acts in this country will make it more difficult for our manufacturers to compete in the markets of the world. As instances to bear out his belief, he declared that Germany, which established compensation measures in 1895 and England, which adopted such measures in 1891, have thrived in their foreign trade.

New Processes to Blame

In the general discussion on safety problems, Dr. Leonard Waldo emphasized the importance of modifying the dangers peculiar to operations at each plant, so that the men working in that plant will know specifically against what to guard. Most of the accidents which happen nowadays, Dr. Waldo believed, are incidental to the operation of new processes with which the men have not yet had time to become thoroughly familiar. As an instance, he mentioned the use of new fuels, such as powdered coal, which often causes severe injuries. Dr. Waldo recommended that employers make a study of all machines and processes in their plants to the end that they may so instruct the men as to enable them to guard all injuries. Dr. Brashear gave an instance of the effect of drinking upon the working efficiency of men. In the Pittsburgh district, as elsewhere, it is the custom of many of the men frequently to patronize the nearby saloons. The president of the Cambria Steel Co. recently told him, said Dr. Brashear, that as a result of the wave of reformation which was caused by the Billy Sunday movement in that district, many of the men had quit drinking and so marked was the effect of this change that the increase in the value of the product of several hundred men who had ceased drinking had been $100,000 in a single month. Wistar E. Patterson, Philadelphia, who is connected in an engineering capacity with the J. G. Brill Co., Harrison Supply Co. and the Electric Storage Battery Co., stated that safety does pay in dollars and cents, as has been demonstrated amply at the plants of these concerns. Before the safety movement reached the Brill plant, accidents there averaged 266 a month and caused the loss of more than 1,000 working days a month. During the past year, the total number of accidents at the plant was 480, while the time lost has averaged 40 days a month, and the safety campaign thus has resulted in a direct saving to these companies of thousands of dollars a month. The Brill company, said Mr. Patterson, reduced its accidents by 20 per cent alone by the use of guards. Its greatest efforts, however, were expended along educational lines. Bulletins were published, safety-first slips were inserted in pay envelopes and every conceivable means was employed to impress upon the men the seriousness of the safety movement. In a few cases, where the men would not co-operate in this work, they finally were discharged. One result of the greatly reduced number of accidents at the three plants in question, said Mr. Patterson, is the fact that it is not necessary to take on so many new men to replace those lost temporarily through injuries and this feature has a double effect, since the presence of new men is one of the greatest perils around a manufacturing plant.

Hollis Godfrey, president of Drexel Institute, Philadelphia, submitted a paper entitled "The Application of Engineering Methods to the Problems of the Executive, Director and Trustee". In this paper, the author endeavored to determine the methods by which the service of a consulting engineer may be made of the greatest value to the executive of the corporation or to a board of directors or trustees during the interregnum in an executive office. An experience of several years has shown the following method to be of value: Defining, on the basis of facts shown by engineering study, the policies of a business; expressing in simple, useful form, the definition obtained and construction on the basis of the studies made. The consulting engineer who is serving a corporation should present to the executive a general, preliminary, co-operative study of the field to determine what lines are most worthy of study, a determination of what facts should be known about those lines, a careful collection and intensive study of the facts existing in the lines chosen, the translation of the facts collected in the light of their relation to other departments of the business and a method for the constructive use of the facts obtained. The co-operative engineering adviser to an executive must be able to distinguish clearly between records which are vital to the future policies of a business and those which are merely historical. He must omit many engineering refinements to avoid doing work that costs more than it is worth.

A paper entitled "Gas Producers with By-Product Recovery", by Arthur H. Lymn, presented an historical resume of the development of the by-product producer gas industry in Europe. The committee on standardization of special threads for fixtures and fittings, submitted a report on straight pipe threads. Other papers which were submitted were as follows: "The Engineer and the Business of Fire Insurance", by Joseph P. Gray; "The Connors Creek Plant of the Detroit Edison Co.", by C. F. Hirshfeld; "Modern Electric Elevators and Elevator Problems", by David Lindquist; "A Novel Method of Handling Boilers to Prevent Corrosion and Scale", by Allen H. Babcock; "Proportioning Chimneys on a Gas Basis", by A. L. Menzin; "Turbines vs. Engines in Units of Small Capacities", by J. S. Barstow; "Design of Fire Tube Boilers and Steam Drums", by F. W. Dean; "Circulation in Horizontal Water Tube Boilers", by Paul A. Bancel; "Performance and Design of High Vacuum Surface Condensers," by Geo. H. Gibson and Paul A. Bancel; "Higher Steam Pressures", by Robert Cramer; "Oil Engine Vaporizer Proportions", by Louis Illmer; "Foundations" by Chas. T. Main; "Heating by Forced Circulation of Hot Water in Textile Mills", by Albert Greene Duncan; "The Flow of Air Through Thin-Plate Orifices", by Ernest O. Hickstein; "Relative Value of Private and Purchased Electric Power for Textile Mills", by Frank W. Reynolds and Dan Adams; "Operation of Parallel and Radial Axles of a Locomotive by a Single Set of Cylinders", by Anatole Mallet; "Electricity and Strength of Stoneware and Porcelain", by Jas. E. Boyd and "Unique Hydraulic Power Plant at the Henry Ford Farms", by Mark A. Replogle.

Social Features

The convention was featured by the usual reunions of the alumni of the various engineering colleges and universities. The usual excursions also were provided, these including trips of inspection to the Woolworth and municipal buildings, the Brooklyn navy yard, the aviation field at Garden City, Long Island, the plants of the Harrolds Motor Car Co., Long Island City, and the Vitagraph Co. of America, Brooklyn, and the 74th street station of the Interborough Rapid Transit Co. Entertainment features included a smoker Wednesday evening, the annual banquet on Thursday evening, a reception and tea for the visiting ladies, etc.

Detroit Objects

Detroit, Dec. 14.—According to present plans, this city will be taxed ten times as much as the rest of the United States in supplying the funds raised under the proposed special taxes in President Wilson's message to congress. This city must pay, the available figures indicate, an average of $6 annually for every man, woman and child; the average for every man, woman and child in the remainder of the country is 60 cents. Detroit, then, with about one 150th of the population of the country will be called upon for one 15th of the funds.

The objection, as should have been told in the opening paragraph, comes because of the proposal to tax automobiles, gasoline and naphtha, pig iron, fabricated iron and steel and bank checks.

"The American public will not stand for any such unfairness as the proposed taxes on automobiles and gasoline," declared Harry M. Jewett, president of the Paige-Detroit Motor Co.

"The administration will see the people rising against this imposition in no unmistakable way."

Iron and Steel Institute Plans

The council of the Iron and Steel Institute announces that the annual meeting will take place on Thursday and Friday, May 4 and 5, and the autumn meeting on Thursday and Friday, Sept. 21 and 22, 1916. Both meetings will be held at the rooms of the Institution of Civil Engineers, Great George street, Westminster, London. Sir William Beardmore, Bart, will be inducted into the chair as the new president of the institute, in succession to Dr. Adolphe Greiner, deceased.

The bessemer gold medal for 1916 will be presented to F. W. Harbord, honorary consulting metallurgist to the ministry of munitions.

It has been decided not to hold an annual dinner next year.

Will Make Drop Forgings

Indianapolis, Dec. 15.—The Imperial Drop Forge Co. was organized here last week with a capital stock of $200,000 to manufacture drop forgings. The new company will take over the plant of the old H. J. Martin Forging Co., 510 South Harding street, and about 200 men will be employed. More than 100 men already are at work in the plant.

In assuming control of the property, the company announced that extensive improvements will be made and that the number of men employed will be doubled. The concern expects to increase the capacity of the plant in the near future.

The temporary officers that have been elected follow: President, Chas. H. Bonbright; vice president, Tom Walker; secretary, R. I. Gale; treasurer, F. J. Weiss; factory manager, George Desautels; directors, George Desautels, David P. Williams, Charles H. Bonbright and Fred J. Weiss.

Mr. Gale, who is actively in charge of the business end of the company, formerly was connected with the Keeler Brass Co., Grand Rapids, Mich.

Seeking a Broader Market

A charter has been granted to the National Transit Pump & Machine Co., of Oil City, Pa., with a capital stock of $2,545,000. This is the largest amount of capital authorized by the state of Pennsylvania for a new corporation in a long time. A bonus of $8,483.34 was paid to the state.

The new company represents what has heretofore been known as the National Transit Co., department of machinery, which owns practically all of the stock of the new company. No change in the personnel of the management has as yet been announced, the officers of the parent company continuing in their various capacities in the management of the subsidiary organization.

For 34 years this department of the National Transit Co. has been engaged in the manufacture of engines and pumping machinery to supply the great demands of the Standard Oil Co. and its old subsidiaries.

The extensive plant at Oil City has recently been greatly enlarged, and, with its added facilities, the company is now seeking a broader market for its products, which include gas and oil engines, diesel engines of the very latest type, pipe line supplies and fittings, compressors and pumping machinery.

The plant is now running at full capacity with two shifts.

Large Boiler Contract.—The Edge Moor Iron Co., Edge Moor, Del., recently booked what is believed to be the largest contract for boilers ever placed. This contract, which involved 140 boilers, each having a capacity of 600 horsepower and 200 pounds pressure, was let to the E. I. du Pont de Nemours Powder Co. They are being installed in a number of buildings at the new Hopewell plant of that concern at City Point, Va.

Remarkable

Increase in Unfilled Orders of Steel Corporation

Another surprising showing as to the large volume of business booked was made by the monthly statement of unfilled orders of the United States Steel Corporation, as of Nov. 30, 1915, which showed the remarkable increase of 1,024,037 tons. This has been exceeded by only one other month since the present method of announcing unfilled monthly tonnage was adopted. In October, 1912, the increase was 1,042,874 tons. The November increase far exceeded expectations, as the largest predictions had fallen short of it by several hundred thousand tons. The total orders of the Steel Corporation were 7,189,489 tons on Nov. 30, which is the largest total since March 31, 1913. Some computations have figured that the bookings of the Corporation in November were not far from 90,000 tons a day or considerably in excess of the previous month, when another heavy gain was shown.

Date.	Total.	Change, tonnage.	Change, per cent.
Nov. 30, 1915....	7,189,489	1,024,037+	16.63+
Oct. 31, 1915....	6,165,453	847,834	14.06+
Sept. 30, 1915....	5,317,618	409,163+	8.13+
Aug. 31, 1915....	4,908,455	20,085—	0.04—
July 31, 1915....	4,928,640	250,344+	5.35+
June 30, 1915....	4,678,196	413,598+	9.69+
May 31, 1915....	4,264,598	102,354+	2.46+
Apr. 30, 1915....	4,162,244	93,505—	2.21—
Mar. 31, 1915....	4,255,749	89,622—	2.06—
Feb. 28, 1915....	4,345,371	96,800+	2.28+
Jan. 31, 1915....	4,248,571	411,928+	10.74+
Dec. 31, 1914....	3,836,643	512,051+	15.40+
Nov. 30, 1914....	3,324,592	136,505—	3.94—
Oct. 31, 1914....	3,461,097	326,570—	8.62—
Sep. 30, 1914....	3,787,667	425,664—	10.01—
Aug. 31, 1914....	4,213,331	54,742+	1.32+
July 31, 1914....	4,158,589	125,732	3.12+
June 30, 1914....	4,032,857	34,697+	0.86+
May 31, 1914....	3,998,160	278,908—	6.98—
Apr. 30, 1914....	4,277,068	376,757—	8.09—
Mar. 31, 1914....	4,653,825	372,615—	7.42—
Feb. 28, 1914....	5,026,440	412,760+	8.95+
Jan. 31, 1914....	4,613,680	331,572+	7.74+
Dec. 31, 1913....	4,282,108	114,239—	2.59—
Nov. 30, 1913....	4,396,347	117,420—	2.60—
Oct. 31, 1913....	4,513,767	490,018—	9.79—
Sep. 30, 1913....	5,003,785	219,683—	4.24—
Aug. 31, 1913....	5,223,468	175,888—	3.03—
July 31, 1913....	5,399,356	407,965—	7.03—
June 30, 1913....	5,807,317	517,005—	8.18—
May 31, 1913....	6,324,322	654,440—	9.38—
Apr. 30, 1913....	6,978,762	490,194—	6.55—
Mar. 31, 1913....	7,468,956	187,758—	2.45—
Feb. 28, 1913....	7,656,714	170,654—	2.18—
Jan. 31, 1913....	7,827,368	104,796—	1.32—
Dec. 31, 1912....	7,932,164	79,281+	1.01+
Nov. 30, 1912....	7,852,883	258,502+	3.40+
Oct. 31, 1912....	7,594,381	1,042,874+	15.33+
Sep. 30, 1912....	6,551,507	388,132+	6.29+
Aug. 31, 1912....	6,163,375	206,296+	3.46+
July 31, 1912....	5,957,079	149,773+	2.58+
June 30, 1912....	5,807,346	56,363+	0.98+
May 31, 1912....	5,750,983	86,983+	1.52+
Apr. 30, 1912....	5,664,885	360,044+	6.97+
Mar. 31, 1912....	5,304,841	149,359—	2.79—
Feb. 29, 1912....	5,454,200	74,479+	1.38+
Jan. 31, 1912....	5,379,721	294,960+	5.71+
Dec. 31, 1911....	5,084,761	942,806+	23.24+
Nov. 30, 1911....	4,141,955	447,627+	12.06+
Oct. 31, 1911....	3,694,328	83,011+	2.25+
Sep. 30, 1911....	3,611,317	84,668—	2.34—
Aug. 31, 1911....	3,695,985	111,900+	3.33+
July 31, 1911....	3,584,085	223,027+	7.16+
June 30, 1911....	3,361,058	247,871+	7.96+
May 31, 1911....	3,113,187	105,617—	3.28—
Apr. 30, 1911....	3,218,704	228,597—	6.63—
Mar. 31, 1911....	3,447,301	46,758+	1.37+
Feb. 28, 1911....	3,400,543	289,624+	9.31+
Jan. 31, 1911....	3,110,919	436,163+	16.30+
Dec. 31, 1910....	2,674,757	85,656—	3.09—
Nov. 30, 1910....	2,760,413	111,536—	3.88—
Oct. 31, 1910....	2,871,949	286,157—	9.12—
Sep. 30, 1910....	3,159,106	379,088—	10.74—
Aug. 31, 1910....	3,537,128	433,803—	10.92—
July 31, 1910....	3,910,931	286,863—	6.72—

Great Britain Bans Machine Tools

Embargo Not Definite Regarding Exceptions—Russian Inquiry Active—Domestic Users Buy Heavily—Crane Builders Swamped

AMONG the leading developments in the machine tool market is the publication of the following cablegram from the American embassy in London under date of Dec. 2: "A royal proclamation, of Nov. 30, prohibits, after Dec. 21, the importation into the United Kingdom of all machine tools and parts thereof, except small tools. A further exception is made in favor of machine tools and parts thereof, imported under the license of the board of trade and subject to the provisions and conditions of such license."

This cablegram has aroused considerable interest in the trade, but outside of its contents no word appears to have been received regarding the institution of such a policy by Great Britain. The best opinion at present seems to be that the proclamation does not aim to cut off imports of machine tools into Great Britain, but to centralize purchases in the future. If the latter is the object, the only surprising feature is that this proclamation was not issued a year or more ago, instead of at a time when Great Britain's machine tool requirements are, to a large extent, satisfied.

The machine tool market continues to be featured by a continued active demand from Russia, which involves, in addition to lathes, a general line of tools. Some heavy purchasing also is being done in this country by French interests. As noted in previous reports, however, the English demand is of diminishing proportions. Good business continues to come from the domestic munition makers, but no spectacular transactions are reported. Buying by domestic industrial concerns continues active and good orders especially are coming from the ship building companies and the railroad car makers. The Wm. Cramp & Son Ship & Engine Building Co. and the Fore River Ship Building Corporation placed some good business during the week; the former company continues in the market for lathes. Among the car companies which have placed large orders are the American Car & Foundry Co., the Standard Steel Car Co., the Forged Steel Wheel Co. and the Keith Car & Foundry Co. Good orders continue to come out from some of the automobile makers.

Among eastern concerns which are extending their capacities are the Davis-Bournonville Co., Jersey City, N. J.; Harlan & Hollingsworth Corporation, Wilmington, Del.; International High Speed Steel Co., Rockaway, N. J.; Autocar Co., Ardmore and Oakmont, Pa.; Colonial Steel Co., Boston; Rochester Stamping Co., Rochester, N. Y.; Campbell Electric Co., Lynn, Mass.; Balbach Smelting & Refining Co., Newark, N. J.

General Inquiry Good in Chicago

Domestic inquiry and buying are growing better and price no longer occupies so important a place in negotiations. The firms desiring tools apparently care more for delivery than for cost. This inquiry is coming from all sources, railroads, manufacturers of mining machinery and mining companies themselves, makers of oil well supplies and machine shops engaged in other lines of business. Deliveries from machine tool builders are falling behind, although labor difficulties have been settled to a great extent. Second-hand machinery is almost impossible to obtain. Railroad buying is active. The North-Western recently secured a few tools, including a number of bolt cutters. The Great Northern railroad has bought most of the equipment asked for in its recent list. The Great Northern list included the following: 16-inch x 12-foot lathe, 28-inch upright drill, both motor-driven; 3 x 10-inch pipe machine, 24-inch shaper, grinder direct-driven for 18 x 3-inch wheels, 48-inch grindstone machine, 1,500-pound steam hammer, two railroad shop forges with individual motor-driven blowers, heavy duty vertical wood boring machine, 30-inch saw table, 30-inch x 18-foot engine lathe, 5-foot semi-universal radial drill, 30 x 30 x 8-inch planer, 250-ton wheel press, 36-inch band saw, small jointer, punch and shear with 26-inch throat, 3-inch bolt cutter, 11 x 12-inch automatic steam engine and 60-kilowatt electric generator.

Steel Companies Buy Heavily

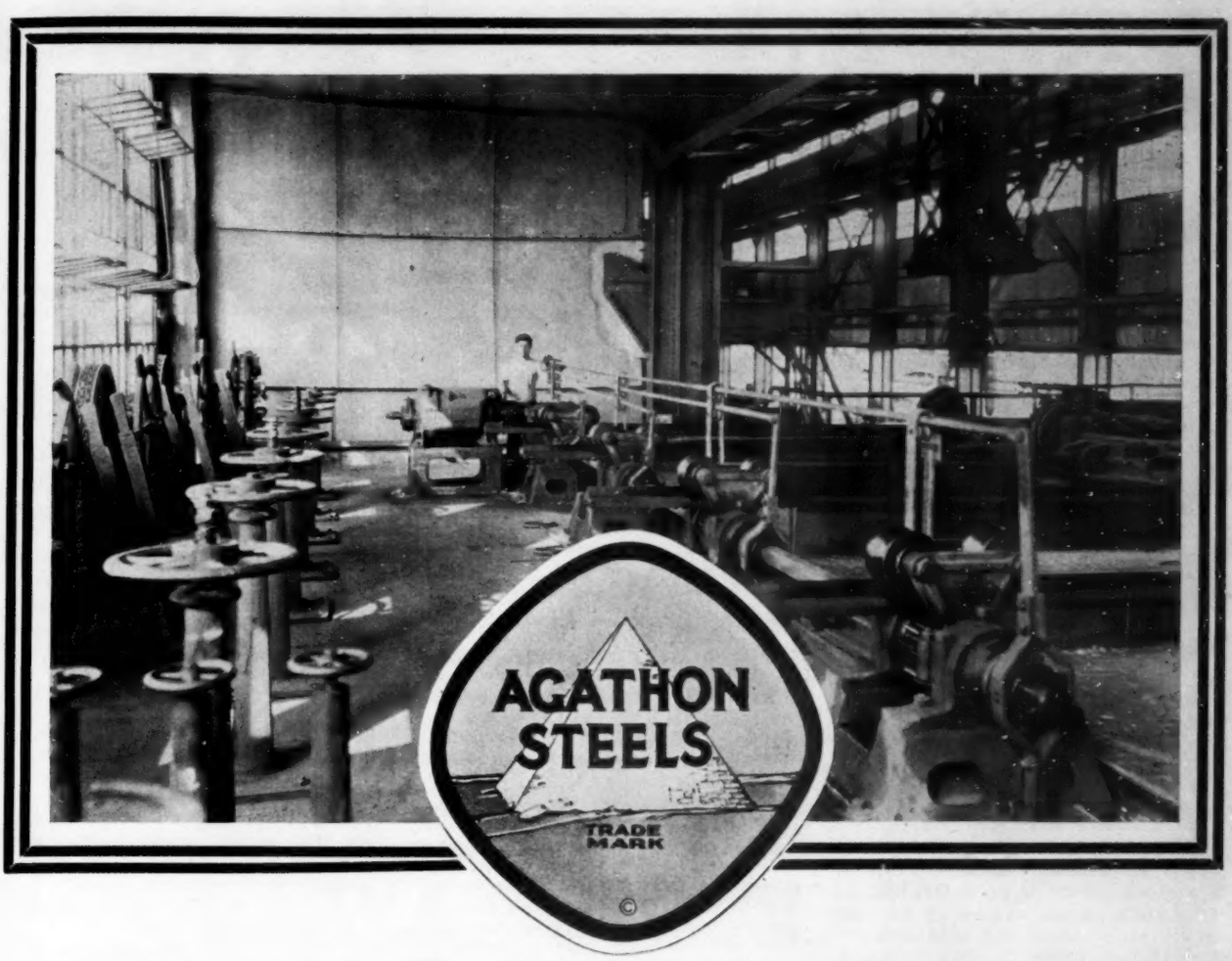
Buying of electric traveling cranes features the Pittsburgh machinery market. One of the largest orders placed in many years has been distributed by the Illinois Steel Co. and the Indiana Steel Co., Chicago, which have closed for a total of 67 cranes, having capacities ranging from 10 tons to 200 tons. The contract, which will take several months to fill, was awarded an Ohio crane builder. The American Sheet & Tin Plate Co. early next week will close for 11 cranes for an extension to the plant at Gary, Ind. The company has revised specifications for a 10-ton crane for its Vandergrift works. Crane builders are unable to promise deliveries in less than from two to six months. The Cambria Steel Co., Johnstown, Pa., and the Forged Steel Wheel Co., Pittsburgh, have been figuring in the market for a number of steam hammers.

Cleveland Market on Up-Grade

Market conditions in Cleveland have improved in the past week. Foreign demand has been good and domestic inquiries numerous. The recent action of Great Britain with regard to the embargo on machine tools had not been discounted, and there is considerable speculation as to its ultimate effect on the tool market in the Cleveland district. The Cleveland Machinery & Supply Co. has been awarded contracts for about 450 tools. One order involves 150 motor-driven 16-inch lathes for shipment to a New York exporting agent. The second contract is for 300 machines for an Ohio concern.

Cincinnati Tool Builders Uneasy

Machine tool builders in Cincinnati are much concerned over the news from London that the importation of all machine tools will be prohibited by the English government after Dec. 21, except by special ruling. None of the machine tool plants in Cincinnati was aware that such action was contemplated by the English government. The Russian government has been a heavy buyer of Cincinnati-made tools lately, having placed large orders for bench grinders and drills, radial drills and milling machines. Do-



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mestic demand from the eastern states is heavy. The strike situation in Hamilton, O., is still acute, and machine shops are unable to operate at full capacities because of the lack of workmen. In Dayton, Columbus and Springfield, O., no serious labor troubles have been experienced. In Cincinnati, striking workmen continue to return to work, and at present practically four-fifths are now back at their old jobs.

EASTERN STATES

AUGUSTA, ME.—The Rochester Machine Co. has been incorporated; $1,000 capital stock; by Ernest L. McLean, S. L. Hall and E. M. Leavitt, Winthrop.

AUGUSTA, ME.—The Lehr Motor Co., has been incorporated to make automobiles and motor vehicles; $500,000 capital stock; by Ernest L. McLean, S. L. Fogg, Frank E. Southard, E. M. Leavitt, Winthrop and Pauline Lowell, Hallowell.

CONCORD, N. H.—The Abbott & Downing Co., is to give up the manufacture of horse-drawn vehicles and will make commercial trucks and motor fire apparatus. It will build its own chassis and buy motors and transmissions.

BOSTON.—The Boston Elevated railroad will build a 1-story concrete, 40 x 120-foot car barn at East Boston, to be used for inspecting and repairing cars.

BOSTON.—The New England Steel & Machine Co., has been incorporated; $100,000 capital stock; by H. Douglas Campbell, Alice H. Campbell and Kathryne E. Smith.

BOSTON.—The Colonial Steel Co., Pittsburgh, has started work on a 2-story warehouse at South Boston, to contain 12,550 square feet of floor space.

FITCHBURG, MASS.—The C. H. Cowdrey Machine Co. is building a 2-story brick, 54 x 84-foot addition to its plant.

FITCHBURG, MASS.—The Fitchburg Foundry Co. has awarded contract for a 1-story, 36 x 48-foot addition to its foundry.

HOLYOKE, MASS.—A contract has been awarded for a 3-story brick, steel and concrete addition to the G. W. Prentiss & Co., wire mills on Dwight street.

LYNN, MASS.—Plans are being prepared for a 4-story, 50 x 100-foot building to be erected by the Campbell Electric Co. in the rear of its present plant at 17 Stewart street. The new building will be used for the manufacture of electrical goods.

MALDEN, MASS.—Plans have been completed for a 2-story brick, 40 x 120-foot factory building at Maplewood station for the H. H. Kelly Co., Boston, which will have a 1-story, 35 x 60-foot boiler house.

MEDFORD, MASS.—The Commercial Chemical Co., New York, has started work on three buildings which will be of steel and concrete one story, 250 x 700 feet, to cost $250,000, and which will be used for the manufacture of acids. They will be located on a part of the 20 acres which the company recently purchased.

PALMER, MASS.—The Wright Wire Co. has awarded a contract for a 3-story, 50 x 160-foot addition.

WORCESTER, MASS. — The Worcester Pressed Steel Co. is adding a 1-story, 40 x 96-foot building for storage to its plant on Barber avenue.

WORCESTER, MASS. — The Worcester Woolen Mill Co., has awarded a contract for a 4-story, 62 x 106-foot concrete mill, work on which will be started in the spring.

WORCESTER, MASS. — Plans have been prepared for a 1-story brick addition to the plant of the Wyman & Gordon Co., Madison and Gold streets, to be used as a machine shop.

WORCESTER, MASS.—Carl R. Anell and Carl H. Anell are to build a 1-story structure of iron and glass on Federal street and will engage in the vulcanizing business under the name of the Federal Vulcanizing Co.

WORCESTER, MASS. — The Worcester Flexible Tubing Co. has been incorporated to make flexible tubing and shafting, wire specialties and machinery; $6,000 capital stock; by Joseph F. Marsolais, Fred Willby, Bridgton, Me.; and Roland V. Marsolais.

PROVIDENCE, R. I.—The B. F. Mason Co. has been incorporated to build boilers and furnaces; $50,000 capital stock; by Rudolph F. Mason, Mabel L. Miller, Warwick; and Charles H. McKenna, Barrington.

WOONSOCKET, R. I.—Contracts for two bridges over Hamlet avenue have been awarded to the E. W. Foley Construction Co., New York, and the bridge at Fairmount to the Spaulding Construction Co., Suffield, Ct.

BRIDGEPORT, CT.—Bids have been received for a brick and steel, 5-story, 50 x 260-foot machine shop for the Bullard Machine Tool Co.

BRIDGEPORT, CT.—The Remington Arms & Ammunition Co., Union Metallic Cartridge Co., is adding a brick 2-story storehouse, 112 x 112 feet, to its Helen street plant.

BRIDGEPORT, CT.—Plans are being prepared for a brick and steel, 1 and 2-story, 100 x 150-foot extension to the tube mill of the Bridgeport Brass Co.

HARTFORD, CT.—The Stone & Webster Corporation, New York and Boston, has been awarded a contract to erect three manufacturing buildings for the S. K. F. Ball Bearing Co., New York, on land recently purchased in Hartford, to be of brick, steel and reinforced concrete fireproof construction, one 1-story, 75 x 300 feet, and two 2-story, 75 x 150 feet.

NEW BRITAIN, CT.—Plans are being prepared for a 3-story brick addition to the factory of the Beaton & Cadwell Mfg. Co., Main street, which will not be built until spring.

NEW LONDON, CT.—Potter & Johnston Machine Co., Pawtucket, R. I., has bought the plant of the Brown Cotton Gin Co., New London.

NEW LONDON, CT. — An addition is planned to the Division street factory of the Standard Brass & Copper Co., owned by the New London Industrial building association.

PLAINVILLE, CT.—Albert F. Rockwell, formerly connected with the New Departure Mfg. Co., Bristol, Ct., has purchased a 10-acre factory site here and is said to contemplate entering the manufacturing business.

PUTNAM, CT.—The Manhassett Mfg. Co., has broken ground for a 2-story 120 x 180-foot addition to its factory on South Meadow and Canal streets.

STRATFORD, CT. — The American Brass Co., has bought a tract of 12 acres on the west bank of the Housatonic river, which will be held for future development.

WESTHAVEN, CT.—The American Buckle Co. has started work on a 2-story, 41 x 46-foot buckle factory.

WEST HARTFORD, CT.—J. M. Craig, 79 Arch street, has started work on a 2-story, 41 x 50-foot foundry to cost $10,000.

WINSTED, CT.—The Winsted Gas & Electric Co., is having plans prepared for a hydro-electric power plant to cost $100,000 and also a concrete dam, work on which will be started in the spring. New equipment will be required for the power house.

BINGHAMTON, N. Y.—The Ansco Co., manufacturer of photographic apparatus, has let a contract for extensions to its power plant to the J. G. White Co., New York.

BROOKLYN, N. Y.—The Drapkin & Goldberg Construction Co., 501 Ashford street, is taking sub-bids on the construction of a 4-story, 40 x 97-foot shop building.

BROOKLYN, N. Y.—Willard E. Tunnison, 262 Greene avenue, is having plans prepared for a 1-story, 50 x 140-foot building, which will be rented for manufacturing purposes.

BROOKLYN, N. Y.—Walter T. Scott, 1453 Fulton street, is taking sub-bids on the construction of a 1-story, 95 x 140-foot building, which will be leased, when completed, for manufacturing purposes.

GATES, N. Y.—The T. H. Symington Co. has let a contract for a 1-story factory addition, to cost $25,000.

IRVINGTON, N. Y.—The Empire Metals Products Co. has purchased the Cosmopolitan publishing building in Irvington.

POUGHKEEPSIE, N. Y. — The Federal Bearings Co. has been incorporated to deal in machinery, tools and mechanical appliances; $1,000,000 capital stock; by J. W. Grover, H. and Herman A. Schatz, Poughkeepsie.

ROCHESTER, N. Y.—The Rochester Stamping Co., 176 Anderson avenue, has let a contract for a 1-story, 60 x 151-foot factory building to cost approximately $8,000.

TARRYTOWN, N. Y. — The Chevrolet Motor Co. recently purchased the Rand drill factory.

ARDMORE, PA.—The Autocar Co. will build a 2-story, 144 x 224-foot factory building at Ardmore, and a 3-story, 150 x 300-foot building at Oakmont, Pa. Stearns & Castor, Philadelphia, are the engineers.

ELLWOOD CITY, PA.—The public service commission has approved the application of the Mahoning & Shenango Valley Railway & Light Co. to buy the plant of the Pennsylvania Power Co., at Ellwood City. The plant will be improved and a dam, to cost $150,000 will be built.

FRANKLIN, PA. — The Atlantic Refining Co. will build a boiler house of steel construction.

FRANKLIN, PA.—The Chicago Pneumatic Tool Co. will double the capacity of its No. 2 plant at Franklin. New equipment will be purchased.

JOHNETTA, PA.—The Johnetta Brick & Coal Co., capital stock $5,000, has been incorporated by I. L. Currier, D. C. Eaton, Pittsburgh; and Charles Hemlock, Johnetta.

MEADVILLE, PA.—The McCroskey-Reamer Co. has increased its capital stock from $40,000 to $120,000.

MT. UNION, PA.—The Mt. Union Refractories Co. has increased its capital stock from $300,000 to $400,000.

NEW CASTLE, PA.—The New Castle Rubber Co. plans to increase capital stock from $500,000 to $1,000,000; stockholders will meet Dec. 27 to vote upon the increase in capitalization.

PITTSBURGH.—Raymond F. Bacon, director of the Mellon Institute of Industrial Research, says two plants for the manufacture of dye stuffs, will be established in Pittsburgh at an early date.

PITTSBURGH. — The Schmidt-McCormick Co., capital stock $5,000, has been incorporated by L. S. Schmidt and W. W. Johnston, Pittsburgh, and A. T. McCormick, Irwin, Pa.;

Announcement

WE are pleased to announce that for the coming season our available tonnage of Lake Superior Iron Ores has been greatly increased by the addition of our Dean-Itasca Mine on the Mesabi and the Pennington Mine on the Cuyuna range so that we can take better care of our trade than ever.

¶ So far this year, 486,374 tons of ore have been taken from the Dean-Itasca mine, mostly since August 1. The shipments next year will be considerably larger. The ore is non-bessemer of good coarse structure.

¶ The Pennington Mine is the first open pit mine on the Cuyuna. The first car load of ore was taken out August 2, 1913, and between that date and the closing of navigation the middle of November, 1913, a little over 100,000 tons were shipped. The shipments for 1915 were 130,000 tons and for 1916 they will be from 300,000 to 350,000 tons. The ore is non-bessemer of good structure and is especially desirable for basic iron. The average analysis last year was 59.20 per cent iron, dried at 212°.

¶ The output of these two mines during 1916, together with our other mines gives us an unusually large tonnage.

¶ We are now taking contracts for this ore and would be glad to figure on your requirements for the coming season.

THE TOD-STAMBAUGH COMPANY

Perry-Payne Building

CLEVELAND, OHIO

to engage in steel construction work; A. J. McCormick is treasurer of the company.

PITTSBURGH. — The Pittsburgh Federal Truck Sales Co., capital stock $25,000, has been incorporated by John W. Lawrence, 1455 North Highland avenue, D. O. Jones and L. S. Hartley, Pittsburgh, to manufacture, deal in and repair motor vehicles.

ATLANTIC CITY, N. J.—Bateman-Mixner Co. has been incorporated to deal in motors, engines, etc.; $100,000 capital; by Walter Bateman, R. W. Mixner, H. C. Mixner, Atlantic City.

BLOOMFIELD, N. J.—The international Arms & Fuse Co. will erect a powder storage plant, about two miles from Bloomfield plant.

CAMDEN, N. J.—The plant of the Farr & Bailey Linoleum Co. was damaged to the extent of $60,000 by fire. Work will be carried on at the other plants of the company.

DUNDEE LAKE, N. J.—Coiform Chemical Co. has been incorporated to manufacture chemicals; $25,000 capital; by Joseph Formanns, Fairlawn; Fred Coirin, Dundee Lake; William L. Rogers, Paterson.

ELIZABETH, N. J.—A. power house will be erected at the General hospital.

ELIZABETH, N. J.—F. C. Vandewater will shortly erect a small plant for the manufacture of gas engines.

FRANKLIN, N. J.—The New Jersey Zinc Co. is erecting 80 buildings to be used as homes for employes.

HACKETTSTOWN, N. J. — The Torrid Heater Co. has been incorporated to manufacture heaters, boilers, etc.; $50,000 capital; by A. R. Riggs, Ledgewood; and W. M. Welsh and J. B. Salmon, of Hackettstown.

JERSEY CITY, N. J.—The Davis-Bournonville Co. has let a contract for the erection of a 2-story, 60 x 200-foot factory here, to cost approximately $70,000.

JERSEY CITY, N. J.—John F. Cassidy, Inc., has been incorporated to manufacture chemicals; $10,000 capital; by L. H. Gunther, S. H. Jarvis and John R. Turner, all of Jersey City.

KEARNEY, N. J.—Officials of the du Pont Powder Co. announce that the plant of the Arlington Co., at Kearney, will not be used as a munition plant.

LAKEHURST, N. J.—Building materials are arriving for the construction of a large plant by the Eddystone Munitions Corporation, Eddystone, Pa., which recently purchased a 4-square mile tract near here. The plant, it is said, will include fully-equipped factory for the manufacture of munitions, a testing ground for shrapnel and long-range shells, an aeroplane factory and an aviation field. In addition, several hundred houses will be erected for employes.

NEWARK, N. J.—The Nickelburg Bros. Co. has been granted a permit to erect a 1-story brick factory on Meadow street.

NEWARK, N. J.—The Balbach Smelting & Refining Co. has been granted a permit to erect a 1-story brick machine shop at Avenue R and Doremus avenue.

NEWARK, N. J.—The General Reducing Co. has been granted a permit to erect a 1-story re-washing building at 86 Franklin street.

PENNSGROVE, N. J. — The du Pont Powder Co. will erect a $30,000 club house for its office force.

ROCKAWAY, N. J.—The M. Hoagland's Sons Co. is about to erect a building for the storage of ferro-manganese.

ROCKAWAY, N. J. — The International High Speed Steel Co., 99 Nassau street, New York, is having plans prepared for a 1-story, 173 x 300-foot manufacturing building to be erected at Rockaway.

TRENTON, N. J.—The American Steel & Wire Co. will build a brick addition.

TRENTON, N. J.—The Hyatt Auto Top Co. has purchased a plot of ground on Wood street and will erect a plant.

TRENTON, N. J.—The Stokes Rubber Co. has let a contract for a 2-story, 100 x 110-foot manufacturing building.

TRENTON, N. J.—The Robert C. Maxwell Co. has purchased a plot on East State street for $27,000, and will erect a manufacturing plant. Electrical signs will be manufactured. Contracts will be let soon.

WILMINGTON, DEL.—Harlan & Hollingsworth Corporation has let a contract for a 2-story, 50 x 120-foot paint shop.

CENTRAL STATES

CINCINNATI.—The Mabley & Carew Co. will build a 6-story addition to its department store on Fountain square.

CINCINNATI.—The Williamson Heater Co. will build an addition to its foundry in Oakley. Equipment will be needed.

CINCINNATI. — Machinery and general equipment amounting to $30,000 will be purchased by Alfred W. Potts, of Branch Hill, who is forming a corporation to engage in the sand and gravel business near Symmes, O.

CINCINNATI.—Browning, King & Co. will build a $150,000 4-story fireproof building on the site of the St. Nicholas hotel at Fourth and Race streets. Plans will be available shortly.

CINCINNATI.—Contracts have been let for the erection of a boiler house for the American Diamalt Co. All equipment will be purchased by G. W. Drach, architect, Cincinnati.

CINCINNATI.—A concrete garage building will be erected on the site of the old Fox tables on East Fifth street to cost $100,000. Equipment details are not available at this time.

CINCINNATI.—The plant of the Globe Automatic Sprinkler Co. of America, has been purchased by the L. B. Harrison estate, including three buildings and an acre of ground. It will be leased to the Toledo Cement Co. and the Gas-O-Tonic Co., for manufacturing purposes.

CINCINNATI.—A sand and gravel corporation with a capital stock of $50,000 is being formed by Mark Stinson, of Remington, O. Seventy-eight acres of land have been purchased, and the plant will have a capacity of 2,000 yards of gravel a day. Equipment will be needed.

NEWTON FALLS, O.—The board of trade announces that a plant will be erected for the manufacture of water tanks and light structural steel. A building 60 x 100 feet will be erected.

YOUNGSTOWN, O.—The Barrett Mfg. Co., a subsidiary of the American Coal Products Co., with offices in New York, is building a plant at Struthers, O., to take care of the coal tar products of the by-product coke oven plant of the Youngstown Sheet & Tube Co.

YOUNGSTOWN, O.—Youngstown Sheet & Tube Co., James A. Campbell, president, will build a benzol plant in connection with its new by-product coke oven plant of 204 Koppers ovens. The benzol plant will be erected by the Semet-Solvay Co., Syracuse, N. Y. The Robins Conveying Belt Co., New York City, will install coke-screening and coke-handling equipment.

WINDSOR, W. VA.—Ralph W. Cooke, industrial agent of the Pennsylvania Lines west, with offices in the Union station, Pittsburgh, has officially announced that the American Gas & Electric Co. has purchased about 600 acres of land at Beech Bottom, near Windsor, and will build a power plant to supply power to plants in the Wheeling district. Contracts for much of the equipment have been placed.

ASHLAND, KY.—The Solvay Coke Co. has purchased additional land and is reported to have plans for the construction of two more by-product units at a cost of $1,000,000.

CARLISLE, KY. — The Carlisle Electric Light & Power Co. has increased its capital stock from $15,000 to $30,000.

CYNTHIANA, KY.—Generating equipment will be installed in the local lighting plant by the Kentucky Utilities Co., Lexington, Ky.

GEORGETOWN, Ky.—The city of Georgetown is considering the establishment of a waterworks and electric light plant, and a site for this purpose has been purchased.

LEXINGTON, KY. — Milton Sanchez is organizing a $500,000 company for the operation of a packing plant.

LEXINGTON, KY. — A building to be equipped for repair work is under construction by the Chesapeake & Ohio railroad. The general offices are at Richmond, Va.

LOUISVILLE, KY.—Brinton B. Davis, Inter-Southern building, is preparing plans for a building for the Kentucky Athletic club, which will be erected at a cost of $100,000.

LOUISVILLE, KY. — The Shannon Bed Spring Co., which has been organized with $15,000 capital stock, will install automatic machinery in the plant which it is now operating.

LOUISVILLE, KY. — The Kentucky Carbonic Co., which has started the erection of a factory building at Thirtieth and Kentucky streets, will purchase special equipment, including tanks and containers for handling carbonic acid gas.

MT. OLIVET, KY.—The Mt. Olivet Light & Power Co. will buy an oil engine, alternator and other equipment for an electric light plant. W. S. Chandler is manager.

EAST CHICAGO, IND.—The Union Iron Products Co. has been incorporated with a capital stock of $50,000, to manufacture, and sell iron and steel products. The directors are C. E. Kitchen, G. L. Carter and S. M. Dague.

INDIANAPOLIS, IND. — The American Foundry Co. is preparing to construct a small addition to its plant to care for increased business.

KOKOMO, IND.—The Globe Stove & Range Co. has increased its capital stock from $500,000 to $600,000.

ROCKPORT, IND.—A contract has been awarded by the county commissioners to the Vincennes Bridge Co. for the construction of six bridges.

GENEVA, ILL.—The Burgess Norton Co. is planning an addition.

ALMA, MICH.—The Republic Motor Co. will erect an addition giving an added space of 50,000 feet.

ALPENA, MICH.—The Michigan Alkali-Huron Portland Cement Co. will erect a 125 x 287-foot addition to its local plant.

ANN ARBOR, MICH.—The Hoover Steel Ball Co. has increased its capital stock from $250,000 to $500,000.

DETROIT.—The Boerder Steel Process Co. has increased its capital stock from $15,000 to $50,000.

DETROIT.—The Hahn Machine & Specialty Co. has increased its capital stock from $5,000 to $10,000.

DETROIT.—The Disco Electric Starter Co. has been incorporated; $250,000 capital stock;

by Sol Meyer, Sydney W. Elston and Howard Streeter.

GRAND RAPIDS, MICH. — The Keeler Brass Co. will erect an addition to its plant.

GRAND RAPIDS, MICH.—The Grand Rapids Foundry Co. has increased its capital stock from $50,000 to $75,000.

HOLLAND, MICH.—W. E. Dunn Co., Chicago, will erect a plant at Holland to build oil engines.

HOMER, MICH.—The Homer Furnace Co. will erect a foundry addition to its plant.

IONIA, MICH.—The Ypsilanti Reed Furniture Co. will erect a 5-story, 80 x 100-foot addition to its local plant. Wernette, Bradfield & Mead, Grand Rapids, Mich., are the architects and engineers in charge of the work.

KALAMAZOO, MICH.—The River Coated Paper Co. plans the erection of a mill to cost $400,000.

LUDINGTON, MICH. — The Four-Drive Tractor Co. has been incorporated; $50,000 capital stock; by John H. Fitch, Elbert J. Jenkins, Clay F. Olmstead and R. J. Fitch.

MUSKEGON, MICH. — The Continental Motor Mfg. Co. will build an 80 x 100-foot plant.

MUSKEGON, MICH.—The Lakey Foundry Co. will erect an addition doubling the capacity of its plant. An electric crane with a capacity of 10 tons will also be installed.

MUSKEGON, MICH. — The Lindermann Machine Co. is constructing an addition and will start to build metal working machines. The addition will be 31 x 153 feet. Thirty-two additional motors will be installed.

MUSKEGON, MICH.—The Michigan Oxhydric Co. has been incorporated to produce oxygen and hydrogen gases for use in the steel plants of Muskegon; William E. Jeannot, president of the West Michigan Steel Co. is interested.

ST. JOSEPH, MICH.—Fay-Kultgen Foundry Co. is building an addition.

APPLETON, WIS.—Foreign paper manufacturers are resuming their demand for American-made equipment, and the J. J. Plank Co., Appleton, specializing in brass rolls, has been awarded a contract.

BUTTERNUT, WIS.—Articles of incorporation have been filed by the Butternut Electric Light & Power Co. The capital stock is $5,000 and the incorporators are W. J. Shulz, H. F. Siewert and E. M. Shulz.

EAU CLAIRE, WIS.—The Gillette Safety Tire Co., Grand Rapids, Mich., which recently decided to establish its plant and offices at Eau Claire, Wis., will award contracts at once for the erection of the first unit of the plant, to be 65 x 300 feet, 1-story, with provisions for wings. Power will be supplied by the Wisconsin-Minnesota Light & Power Co. The Gillette company has a capital stock of $1,000,000. The initial output of the Eau Claire plant will be 100 tires a day. J. S. Wilson is secretary.

GREEN BAY, WIS. — The Green Bay Barker Co., manufacturing knife barkers and other logging and paper mill equipment, has developed a new type of machine and will its capacity, the company is arranging for manufacture the device on a large scale. To accommodate the increased demand a machine shop addition will be erected, plans for which are now being prepared by Foeller & Schober, architects, Green Bay.

JANESVILLE, WIS.—The Janesville Carriage Works, 201 East Main street, will erect a 2-story addition, 36 x 66 feet. C. A. Buchholz is president.

KENOSHA, WIS.—The American Brass Co. is planning to build a plant at Kenosha.

KENOSHA, WIS.—The Thos. B. Jeffery Co., automobiles and motor trucks, is having plans prepared for two 3-story shop additions, and devoted to finishing, assembling and shipping. The company has been working on contracts for war trucks for the past year or more and this has made extensions of the works imperative.

KEWANEE, WIS.—The Chicago Bridge & Iron Co., Chicago, has been awarded a contract for a 110-foot steel tower and an 80,000-gallon steel tank for the municipal waterworks system at Kewanee, Wis. The contract for pipe and accessories was awarded to the Claude Iron Co.

LAKE GENEVA, WIS.—Articles of incorporation have been filed by the Southern Wisconsin Electric Co., Lake Geneva; $100,000 capital stock; by John B. Sanborn, C. E. Blake and W. J. P. Aberg. It is reported that the company plans to merge several public utilities in southern Wisconsin and increase the joint output.

MADISON, WIS.—Two garbage incinerators are included in plans now being prepared by City Engineer F. C. Parker for the proposed disposal system for the east and west districts of Madison. The appropriation is $20,000. The work will be done early next year.

MANITOWOC, WIS. — Earl F. Miller, architect, Dempsey block, has awarded the following principal contracts on the $100,000 factory and shop building for the Aluminum Goods Co., Manitowoc: Structural steel, the Worden-Allen Co., Milwaukee; steel sash, Detroit Steel Sash Co., Detroit; 400,000 feet of flooring, C. Schoch Lumber Co., Manitowoc.

MARSHFIELD, WIS.—The plant of the Felker Bros. Co., Marshfield, was seriously damaged by fire. The company manufactures steel culverts, well casings and agricultural machinery and recently broke ground for a fireproof culvert shop. The building will be rushed to completion and plans are under way for the reconstruction of the damaged plant. A. G. Felker is general manager.

MERRILL, WIS.—The Milwaukee Structural Steel Co., Milwaukee, has received the sub-contract for steel and iron work on the $75,000 Merrill postoffice building through John Lauritzen, Fergus Falls, Minn., general contractor.

MILWAUKEE, WIS.—The A. L. Baer Pipe Co. has been incorporated at Milwaukee with $5,000 capital by John Falbe, A. L. Baer and Nettie Foster.

MILWAUKEE, WIS.—Plans are being prepared to build a bridge at State street in 1916. J. C. Pinner Jr., is superintendent bridges and public buildings.

MILWAUKEE. — The Milwaukee Bridge Co., Milwaukee, has been awarded the steel work on the $40,000 boiler house for the A. O. Smith Co., Milwaukee.

MILWAUKEE.—To meet the extraordinary demands upon its production, the Jaeschke Bros. Foundry Co., 3026 Locust street, is erecting a $15,000 addition fronting on the Milwaukee road tracks. All contracts have been awarded.

MILWAUKEE.—The United States Steel Corporation has awarded a $1,500,000 contract for gas engines for its extensions at Gary, Ind., to the Allis-Chalmers Mfg. Co., Milwaukee. No additional equipment will be required to handle contract.

MILWAUKEE.—A central heating and lighting plant costing $355,000 may be erected in the town of Wauwatosa to serve the various county institutions grouped at that point. The project was planned several years ago but deferred and is being revived by the county board of control. Otto Broecker is secretary.

MILWAUKEE.—The Kleinsteuber Combination Post Co. has been incorporated with $25,000 capital to manufacture fixtures for outdoor transmission systems for electric, telephone, telegraph wires, etc. The incorporators are Oscar Kleinsteuber, Robert Barth and J. F. Parnkopf Jr.

MILWAUKEE.—The Haese Track Sander Co. has been organized at Milwaukee with $100,000 capital to manufacture devices for attachment to locomotives, railway coaches and electric cars. The incorporators include Ferdinand Haese, William Haese and Adolph Haese.

MILWAUKEE.—Plans are being prepared by Van Ryn & DeGelleke, architects, Caswell block, for the proposed Milwaukee School of Trades for Girls, South District, to cost $160,000. It will be erected during 1916. The school will be of brick and concrete, 85 x 120 feet, three stories, with a heating and power plant. Frank M. Harbach is secretary of the school board.

MILWAUKEE. — The Foster Construction Co., Caswell block, Milwaukee, has received the general contract for building a package factory for the Nufer-Cedar Co. at Whitehall, Mich. The plant will consist of three buildings, a 1-story mill, 70 x 100 feet, steel frame; a shop, 30 x 100 feet; and engine and boiler house, 25 x 30 feet. The steel work has been sublet to the C. Hennecke Co., Milwaukee.

MILWAUKEE.—C. E. Malig, architect, department of public works, is preparing plans for a $15,000 power plant and a $20,000 infirmary to be erected at the Blue Mound sanatorium for tuberculosis, Wauwatosa, early next year. The power plant will be of brick, 50 x 70 feet, 1-story and basement. The infirmary will be 70 x 150 feet, two stories. An administration building will be erected later. George R. Ernst, is director.

MILWAUKEE.—The Green Bay & Eastern Railroad Co. has been organized with $50,000 capital to build a 70-mile line from Green Bay, Wis., through Brown, Manitowoc and Sheboygan counties to Sheboygan, Wis. The project has received the approval of the govrenor and awaits the patent of the railroad commission. The promoters include A. C. Lingelbach and G. P. Mattern, Milwaukee; Charles Frazier and Rudie Stockinger, Manitowoc, and Michael Kellner Jr., Kellnersville, Wis.

MILWAUKEE.—John B. Drahonovsky, who organized and is at the head of the J. B. D. Resilient Steel Wheel Co., 671 Smith street, Milwaukee, manufacturing steel wheels for motor cars and trucks, has organized a company, known as the J. B. D. Carbureter Co. to manufacture and market carbureters and other similar appliances and devices for internal combustion engines. The company will have offices and works in the steel wheel plant. The capital stock is $10,000 and the incorporators are Mr. Drahonovsky, E. D. and D. R. Deuster.

MILWAUKEE.—Alfred C. Clas, architect, Colby-Abbot building, has awarded the general contract for the erection of an 8-story hotel and store building, 120 x 200 feet, at West Water and Sycamore streets, Milwaukee, to the Dahlman Construction Co., Milwaukee. The building will be of brick and steel and will be the first unit of a $5,000,000 improvement undertaken by Charles W. Somers, Cleveland, and associates, on the site of the Plankinton hotel property, Grand avenue, West Water, Sycamore and Second streets. The syndicate is represented by Harvey Bros., 73 Euclid avenue, Cleveland.

MINERAL POINT, WIS. — The Mineral Point Zinc Co. is making daily shipments of sulphuric acid from the acid plant recently installed at the smelters near Mineral point. Most of the supply is consigned to the Atlas Powder Co., Senter, Mich. The daily output

of the Mineral Point acid plant is from 25 to 30 tons, and practically all is shipped as soon as finished.

OSHKOSH, WIS.—The Lake Breeze Motor Co., Chicago, Ill., has decided to establish its permanent works and offices in Oshkosh. The company will be reincorporated, capitalized at $50,000, and will be headed by C. C. Chase, chairman of the new industries committee of the chamber of commerce. The association is providing shop quarters for the company in a building being erected for the joint use of the Molle Typewriter Co., formerly of Chicago, and the Lake Breeze company.

RACINE, WIS.—The Racine Iron & Wire Works will rebuild its plant recently damaged by fire.

RACINE, WIS.—The Corliss Steel Co. has been incorporated; $10,000 capital stock; by F. Lee Morton, H. F. Johnson and W. L. Mitchell.

RACINE, WIS.—A plant is being erected by H. J. Stilb at Racine Junction for the Sieverkropp Engine Co., 1200 Eighteenth street. Plans by Edward B. Funston, architect, call for a 1 and 2-story brick and steel building, 50 x 100 feet.

SAUK CITY, WIS.—The Farmers' Packing Co., organized recently, is preparing to erect and equip a packing house, elevator and power plant, to cost between $75,000 and $80,000. Work is to start about March 1. John Schneider is president and general manager.

KANSAS CITY, MO.—Motor Specialties Co. has been incorporated to manufacture shock absorbers; $15,000 capital stock; by E. J. Hess, W. D. Mahoney and O. J. McClaughery.

SCHELL CITY, MO.—E. T. Hartje, 2437 Independence avenue, Kansas City, will install a plant for city lighting, including an oil engine and 50-horsepower generating machinery, in a concrete station.

SPRINGFIELD, MO.—Election will be held Jan. 11, on issuing $400,000 in bonds for an electric light plant. T. J. Moore, city clerk.

ST. LOUIS.—St. Louis Enameled Range Co. has been incorporated; $2,000 capital stock; by F. E. Bryan, W. L. Culver and W. A. Koerner.

ST. LOUIS.—Interlocking Rail & Structural Steel Co. has been incorporated to manufacture interlocking rail joints; Fred. Hyke, president and general manager, 523 Boatmen's Bank building.

ST. LOUIS.—Barnette, Haynes & Barnette, architects, Century building, will take bids about Jan. 1 on an 8-story steel building for the Pulitzer Publishing Co., 212 North Broadway.

DES MOINES, IA.—Plans are being prepared fr a bridge over Four Mill creek, consisting of two 75-foot reinforced concrete arches, to cost $10,000 to $14,000.

SOUTHERN STATES

ALLISTON, ALA. — The Southern Munitions Corporation, recently incorporated with $500,000 capital stock, James Mitchell, president, 120 Broadway, New York, and Birmingham, has leased the Anniston car shops of the Illinois Car & Equipment Co. and will equip it for manufacturing explosive shells and electric steel. A 6-ton Heroult electric furnace and other improvements will be installed at a cost of $100,000.

GADSDEN, ALA.—The Gulf States Steel Co., Birmingham, will install a high-pressure fire pump at its plant at a cost of $15,000.

COLUMBUS, MISS.—An election will be called soon to vote on a $10,000 bond issue for a municipal electric light plant.

ATHENS, TENN. — The Dixie Highway Tire Co. is being organized by Wallace Duff, and will establish an automobile tire factory. The company is capitalized at $26,000.

CHATTANOOGA, TENN.—The Dixie Good Roads Machinery Co. is in the market for an air-compressor with a capacity of 1,200 cubic feet per minute. The equipment is to be steam-driven.

CHATTANOOGA, TENN.—The Tennessee Power Co. is now ready to proceed with the construction of a hydro-electric power plant on Caney Fork river, which has been under consideration for some time.

COWAN, TENN.—The Nashville, Chattanooga & St. Louis railroad, with general offices in Nashville, Tenn., will purchase electrical equipment for the operation of a coaling station at Cowan.

MARYVILLE, TENN.—It is reported that additional furnaces are to be equipped by the Aluminum Co. of America.

OOLTEWAH, TENN.—The Ooltewah Construction & Improvement Co. will purchase a 75-kilowatt transformer and will distribute current from the Tennessee Power Co. to local consumers.

PARIS, TENN.—A factory is to be equipped at once by the Paris Tile, Roofing & Flooring Co., which has been organized with $20,000 capital stock.

NEW ORLEANS, LA.—Bids will be received until Jan. 1 by the board of port commissioners, 200 New Orleans Court building, for a reinforced concrete elevator, 1,000,000 bushels capacity, with equipment. Ford, Bacon & Davis, are the engineers, 921 Canal street.

SHREVEPORT, LA. — The Yarborough Rotary Stock Cutter Co., recently incorporated with $50,000 capital, will equip a plant to manufacture cutters. Bird Bros., Ward building, Shreveport, are in charge.

TEXARKANA, ARK.—Commissioners of Miller county bridge and highway district No. 1 have received plans for a highway bridge over Red river consisting of six spans, 1,400 feet, with a channel span 50 feet vertical lift. Harrington, Howard & Ash, engineers, Kansas City, Mo., are in charge.

TEXARKANA, ARK.—The Morrisson Tie Plate Co. is being formed to manufacture railroad tie plates. O. P. Morrisson is interested.

ATLANTA, TEX.—The Atlanta Electric & Ice Co., will install additional machinery.

GAINESVILLE, TEX.—The Texas Power & Light Co., Dallas, will install a 225-horsepower diesel engine and a 250-kilowatt generator.

GOLTRY, OKLA.—An election will be held Dec. 21 on issuing $11,500 in bonds for an electric light plant. Benham Engineering Co., Oklahoma City, is the engineer.

ENID, OKLA.—The Wensley Pump Co. has been incorporated; $25,000 capital stock; by J. G. Cook, Billings, Okla., and Clarence M. Cook, Garber, Okla.

HEAVENER, OKLA.—H. S. Bliss, president board of trustees, will equip a 150-horsepower electric light plant, the building for which is now under way. Project is being carried on at a cost of $20,000.

MIAMA, OKLA.—A contract will be let soon by county commissioners for 60-foot steel span bridge over Upper Horse creek. Bonds for $85,000 have been voted for bridges.

SAN SPRINGS, OKLA.—The Farm Engineering Co., recently incorporated, is preparing to build the first unit of its plant of steel and glass, 75 x 150 feet. A. J. and O. G. Patch, engineers. The company will manufacture tractor engines for farming.

SHAMROCK, OKLA. — Sapulpa & Oil Fields railroad plans to install an electric power plant to distribute power in the oil fields and for railroad use.

WESTERN STATES

TOPEKA, KAS.—The Santa Fe, Missouri Pacific and Topeka railroads will build a viaduct on East Sixth street. C. W. Kouns is general manager of the Santa Fe.

BILLINGS, MONT. — J. J. Harris, of Hardin, Mont., is interested in the Big Horn Irrigation & Power Co., which plans to utilize the Big Horn river. Plans include a 415-foot dam by which 170,000 to 200,000 horsepower will be generated. Surveys have been completed for a railroad to the site of the dam, to cost about $800,000. Power will be used for constructing irrigation ditches. Estimated cost of the project is $12,000,000.

CULBERTSON, MONT. — Donaldson Bros. will purchase an engine for an electric light plant. Storage batteries will also be installed.

HANOVER, MONT.—The Hanover Gypsum Co. has completed plans for the construction of a plaster mill at its gypsum properties at Hanover. The company has temporary offices at Great Falls, Mont.

IDAHO FALLS, IDA.—J. A. Jones and E. G. Kindred have asked the public utilities commission for a certificate of public convenience with a view to installing a gas plant at Idaho Falls.

CHEHALIS, WASH.—The North Coast Power Co. is planning the construction of a power line from Woodland, Wash., to Vancouver, to pass through Ridgefield and La Center.

NORTHPORT, WASH. — The Northport Smelting & Refining Co. is planning to build an additional smelter costing $200,000.

NORTHPORT, WASH.—The Hercules Mining Co., Wallace, Ida., has placed an order with the Westinghouse Electric & Mfg. Co., for electrical equipment consisting of switches, motors, etc., for its smelter here.

SEATTLE, WASH. — The Pacific States Construction Co., Burke building, has awarded a contract for steel erection on the Fremont avenue bridge to E. Knipe, Northern Bank building.

WENATCHEE, WASH.—County Engineer Warren has made a survey for a steel bridge across Wenatchee river at Wenatchee to be built in the spring.

PORTLAND, ORE.—The Southern Pacific Railway Co. will build the Holgate street viaduct, steel posts and plate girders, at a cost of $55,000.

PORTLAND, ORE.—Plans are being prepared by N. M. Loney, engineer, for a branch plant of the American Can Co. to cost $600,000.

SALEM, ORE.—County court of Polk and Marion counties will build a 780-foot bridge over the Willamette river, costing $200,000. Max Gehlbar is county clerk, Salem.

ST. HELENS, ORE.—The St. Helens Ship Building Co. is considering the enlargement of its plant, so that it can lay down hulls with a maximum length of 350 feet.

SAN FRANCISCO.—A contract will be let soon for a 250-foot viaduct, 12-foot roadway, on Market street, by board of state harbor commissioners. Steel encased in concrete will be used.

ALASKA

JUNEAU, ALASKA.—A plan is being considered for the construction of a $75,000 bridge between Juneau and Douglas.

CANADA

PORT MOODY, B. C.—The Pittsburgh manager of the Port Moody Steel Works is in Port Moody supervising the erection of a plant.

VANCOUVER, B. C.—A contract for the construction of a joint terminal building for the Great Northern railroad has been awarded to the Coast Contract Co., of Vancouver.

VICTORIA, B. C.—Canadian Vincent Valve Co., Ltd., has been incorporated to manufacture drain valves and carry on business as iron founder, etc.; $25,000 capital stock, by Arthur Newham and Roland H. Powell, Victoria, and Charles W. Buckner, Blaine, Wash.

HAMILTON, ONT.—The Monarch Machine & Tool Co. is fitting up an old building on the corner of Ferguson and Young streets for the manufacture of high speed machinery for the shell industry.

PETROLIA, ONT. — The Western Sugar Refining Co., Ltd., has been incorporated to manufacture sugar and by-products and goods of all kinds; $600,000 capital stock; by Ralph D. Mitchell and Daniel J. Kilby, of Cleveland, O.; David A. Gordon, Wallaceburg, Ont., and others.

TORONTO, ONT.—D. M. Gilpin & Co., Ltd., has been incorporated to manufacture iron, steel and other metals; $250,000 capital stock; provisional directors Dalton McC. Gilpin, D'Arcy B. Gilpin and James R. Roaf, Toronto.

TORONTO, ONT. — Kirkland Lake Gold Mining Co., Ltd., has been incorporated to work mines and smelt and refine metals; $2,000,000 capital stock; by David A. Grant, Gideon Grant, Mervil Macdonald, Toronto, and others.

TORONTO, ONT. — Provisional Stone & Supply Co., Ltd., has been incorporated to carry on business as quarry master and manufacturer of building materials; $40,000 capital stock; by Wm. H. Irving, Henry H. Davis and James S. Beatty, Toronto.

WALKERTON, ONT. — Imperial Cordage Co., Ltd., has been incorporated to manufacture rope; $150,000 capital stock; by John Connor, St. John, N. B., and Edward A. D. Morgan and Salluste Lavery, Montreal.

MONTREAL, QUE. — The Federal Brass Co., Ltd., has been incorporated to operate foundries and refineries; $50,000 capital stock; by Joseph P. A. Belanger, Louis J. C. Gagnon, Joseph E. A. Blais and others, Montreal.

MONTREAL, QUE. — Canadian Electro-Products, Ltd., has been incorporated to manufacture metals; $500,000 capital stock; by Walter R. L. Shanks, Daniel P. Gillmor, Francis G. Bush and others, Montreal; J. S. Norris of the Montreal Power Co. and Julian C. Smith, of the Shawinigan Power Co., are interested. The new company proposes to smelt 50 tons of steel per day by the electric smelting process and will have one unit for 25 tons per day operating in about six weeks.

New Trade Publications

RIVETS, CHAINS.—The Edwin B. Stimpson Co., Brooklyn, N. Y., has issued a complete 36-page catalog devoted to descriptions and illustrations of its line of washers, chains, hinges, rivets, eyelets, shells, tubes and nails. Each product is separately described and illustrated in an attractive manner. The company manufactures copper, brass and iron products.

STEAM SHOVELS.—An attractive booklet has been issued by the Ball Engine Co., Erie, Pa., devoted to its line of steam shovels. The pamphlet is given over largely to interesting photographs showing these shovels in operation on a wide variety of work. In describing this shovel, it is pointed out that three levers and one foot brake give the operator complete automatic control. The rated capacity of the shovel per hour in deep cuts is 50 to 60 cubic yards and in shallow cuts, 25 to 35 cubic yards.

JOLT-RAMMING MACHINES. — The extensive line of jolt-ramming machines manufactured by the Mumford Molding Machine Co., Chicago, is illustrated and described in a 12-page bulletin. These machines are built in various sizes for different classes of work, ranging in table sizes from 15 x 20 inches to 84 x 168 inches, and have lifting capacities at 80 pounds air pressure from 350 to 3,900 pounds. The sizes of the cylinders also vary from 3 to 32 inches. The pamphlet is well-illustrated and contains considerable interesting information on jolt-ramming molding machine operations.

CONDUCTORS.—The Western Conduit Co., Youngstown, O., has issued an attractive catalog giving a description of its armored conductor for wiring either new or old buildings. The conductor consists of a rubber covered wire completely protected by a heavy galvanized flexible armor. The armor presents a smooth and flattened surface which permits of fishing with a minimum of friction. The conductor is extremely flexible. A number of photographs are presented showing the methods of installing this conductor. The Western Conduit Co. is a subsidiary of the Youngstown Sheet & Tube Co.

GRINDERS. — An adjustable grinder, designed especially for the steel industry, is described and illustrated in a recent pamphlet of the Stow Mfg. Co., Binghamton, N. Y. The motor shaft combination of this grinder is mounted on a truck, making the tool easily transportable to any part of the shop and thus eliminating the necessity of taking the work to the tool. With direct current equipment, speed variation is secured by means of a plunger in the pole piece which operates to change the reluctance of the magnetic circuit. This speed variation is said to allow for the consuming of worn emery wheels down to a minimum. The grinder also is furnished for use with alternating current. It can be used with either scratch brush or emery wheel.

DRILL HOLE COMPASS.—E. E. White, Ishpeming, Mich., has issued a folder describing the Maas drill hole compass for determining the direction and dip of drill holes. This compass is placed in a thermos bottle or glass tube with hot liquid gelatine and lowered in a watertight phosphor bronze case, with a tube containing hydrofluoric acid. When the gelatine is cold the rods are pulled, the direction of the needle is marked on the tube which contained the acid and the direction and inclination of the hole determined from this tube in a goniometer. This compass, it is claimed, will survey drill holes to a depth of 3,000 feet for both direction and inclination. Mr. White is American agent for this compass and has rented a number of the devices to exploring companies in the United States.

CORE DRILLS—The line of core drills manufactured by the Ingersoll-Rand Co., New York, is described in a 128-page catalog recently published. In a preliminary discussion of the uses of core drills, it is pointed out that the principal function of the core drill is the determination of the character, order, thickness and extent of the materials beneath the earth's surface, by means of cylindrical cores which the drill extracts. The advantages of the core drill are familiar to those interested in coal and metal mines, stone quarries, canal or tunnel developments. The booklet is well illustrated and gives the sizes and capacities of the different types manufactured by the Ingersoll-Rand Co. In addition a number of views are presented showing the apparatus in operation in various fields.

RECORDING GAGES. — The Foxboro Co., Foxboro, Mass., recently has published an exceedingly comprehensive 40-page catalog devoted to its line of recording gages. No multiplying devices are found in the actuating element, which might cause loss of motion or would have a tendency to get out of order. All movements are positive in their action. The company's recorders are made in three sizes, 8, 10 and 12 inches, for any range from full vacuum up to 20,000 pounds pressure per square inch. Among the different products described and illustrated are standard round form instruments, two-pen recording gages, suppressed scale recording gages, recording gages with electric alarm attachment, portable recording gages with and without U gage, helical and diaphragm tube movement, devices for protection against moisture, dust and fumes, differential recording gages, charts, chart files, chart holders and recording instruments for gas and creosoting plants.

FOUNDRY EQUIPMENT AND SUPPLIES. —An exceedingly comprehensive catalog, containing 372 pages devoted to foundry equipment and supplies, has been issued by the J. S. McCormick Co., Pittsburgh. The first section is devoted to foundry facings of all kinds, core washes, sand, core binders, brushes, etc. In the equipment section are included descriptions of pneumatic floor and bench rammers, molder's benches, sand blast supplies and equipment, rosin grinders, wax taper machines, foundry riddles and sand sifters of various types, sand mixing and grinding machines, flasks, melting furnaces for brass foundrymen, magnetic separators, cinder crushers, patternmaker's equipment, sprue cutters and other machinery for the cleaning room, hoists, cranes, etc., testing machines, air compressors, molding machines, core ovens, coremaking machines, cupolas, blowers, ladles, ladle buggies, etc. The catalog is unusually complete in every detail and practically every device used in foundry operations is illustrated and described.

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

(Delivery April 1.)

Bessemer, valley	$19.00 to 19.50
Bessemer, Pittsburgh	19.95 to 20.45
Basic, Pittsburgh	18.95 to 19.45
Basic, eastern Pa.	18.00 to 18.25
Malleable, Pittsburgh	18.95 to 19.45
Malleable foundry, Chicago	18.00
Malleable foundry, Philadelphia	20.00 to 20.50
Malleable foundry, Buffalo	18.00 to 19.00
No. 1X foundry, Philadelphia	19.25 to 19.75
No. 2 foundry, Pittsburgh	18.95 to 19.45
No. 2 fdy., first half, Pbgh.	15.95 to 16.45
No. 2 foundry, first half, valley	15.00 to 15.50
No. 2 foundry, Cleveland	18.30
No. 2 foundry, Ironton	17.50 to 18.00
No. 2 foundry, Chicago	18.00
No. 2X foundry, Philadelphia	19.00 to 19.50
No. 2X fdy., N. J. tidewater	19.00 to 19.50
No. 2X foundry, Buffalo	17.50 to 18.50
No. 2 plain, Philadelphia	18.50 to 19.00
No. 2 plain, N. J. tidewater	18.50 to 19.00
No. 2 plain, Buffalo	17.00
No. 2 southern, Birmingham	14.00 to 14.50
No. 2 southern, Cincinnati	16.90 to 17.40
No. 2 southern, Chicago	18.00 to 18.50
No. 2 southern, Phila. delivery	17.50 to 18.00
No. 2 southern, Cleveland	18.00 to 18.50
No. 2 south'n, New York docks	17.50 to 18.00
No. 2 southern Boston, docks	16.75 to 17.25
No. 2 south. interior, New Eng.	18.00 to 19.00
No. 2 southern, St. Louis	17.90
Virginia No. 2X furnace	16.50 to 17.00
Virginia 2X, Philadelphia	19.25 to 19.75
Virginia 2X, Jersey City	19.50 to 20.00
Virginia 2X, Boston points	19.75 to 20.25
Gray forge, eastern Pa.	17.50 to 17.75
Gray forge, Pittsburgh	18.45
Gray forge, Birmingham	10.50
Silveries, 8 per cent, Jackson, O.	25.00
Silveries, 8 per cent, Chicago	25.50 to 26.50
Standard low phos., Phila.	30.00 to 31.00
Lebanon low phos., furnace	31.00 to 32.00
Low phos., Pittsburgh	30.00 to 31.00
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	19.25 to 22.25
Charcoal, Buffalo	19.00 to 20.00
Charcoal, Birmingham	21.50

IRON ORE

Lake Superior Ores.
(Lower Coke Reports.)

Old range Bessemer, 55 per cent.	$4.50
Mesabi Bessemer, 55 per cent.	4.20
Old range, non-Bess., 51½ per cent.	3.75
Mesabi non-Bessemer, 51½ per cent.	3.55

Foreign Ores.
(Per unit Philadelphia.)
(Prices nominal.)

Foreign Bess., 50 to 65 per cent.	8 to 8½
For'n non-Bess., 50 to 65 per cent.	8 to 8½

COKE

(At the ovens.)

Connellsville furnace	$2.35 to 2.50
Connellsville fur., first half	2.35 to 2.50
Connellsville foundry	3.00 to 3.25
Connellsville fdy. contr.	3.00 to 3.25
Wise county furnace	2.75 to 3.00
Wise county foundry	3.00 to 3.25
Pocahontas furnace	2.75 to 3.00
Pocahontas foundry	3.00 to 3.25
New River, foundry	3.25 to 3.75
New River, furnace	3.00 to 3.25

FERRO ALLOYS AND STEEL MAKING METALS

Ferro mang., delivered (prompt)	100
Ferro mang., Balti., (future)	100 to 108
Spiegeleisen 20 per cent, furnace	28.00
Ferro-silicon, 50 per cent, Pbgh.	83.00 to 85.00
Ferro-silicon, 50 per cent, Phila.	83.00 to 85.00

Bessemer ferro-silicon, 9 per cent to 10 per cent, $27.00; 10 ot 11 per cent, $28.00; 11 to 12 per cent, $29.00; 12 to 13 per cent, $30.00 a ton at the furnace at Ashland, Jackson and New Straitsville, O.

Ferro-chrome, 4 to 6 per cent carbon, 25 cents per pound; 2 per cent carbon, 45 cents per pound, delivered.

Ferro-vanadium, $3.15 per pound of contained alloy, Pittsburgh.

Ferro-carbon titanium, 8 to 12½ cents per pound in carloads.

Nickel, 50 to 55 cents per pound.

Freight Rates via Panama Canal

Rates on finished materials, including plates, shapes, bars, wire, nails, etc., to Pacific coast points via Panama canal, per 100 lbs., in carload lots, exclusive of insurance and dockage.

From New York	$0.40
From Pittsburgh	.619
From Youngstown	.619
From Niles	.619
From Wheeling	.619
From Steubenville	.619
From Johnstown	.604
From Coatesville	.545
From Steelton	.555
From Bethlehem	.529
From Cleveland	.65
From Chicago	.765

Ferro-tungsten, nominal.
Cobalt metal, nominal, Pittsburgh.
Aluminum, 59 to 60 cents per pound, New York.
Ferro-molybdenum, Pittsburgh, nominal.

SEMI-FINISHED STEEL

Open hearth billets, Phila.	$36.00 to 38.00
Bessemer billets, Phila.	28.00
Forging billets, Phila.	50.00 to 55.00
Forging billets, Pbgh. (nominal)	55.00
Forging billets, Chgo.	36.00 to 40.00
Wire rods, Pittsburgh (nom.)	39.00 to 40.00
Bess. bill., Youngstown	30.00 to 31.00
Open hearth billets, Youngstown	30.00 to 31.00
Bessemer billets, Pittsburgh	30.00 to 31.00
Open hearth billets, Pittsburgh	30.00 to 31.00
Bess. sheet bars, Youngstown	31.00 to 32.00
Op. h'th sheet bars, Youngstown	31.00 to 32.00
Bess. sheet bars, Pittsburgh	31.00 to 32.00
Op. h'th sh. bars, Pbgh.	31.00 to 32.00
Muck bar, Pittsburgh (nominal)	34.00

RAILS AND TRACK MATERIAL

Stand. Bess., rails, Pbgh. & Chg.	1.25c
Stand. op-h'th rails, Pbg. & Chg.	1.34c
Light rails, 8 to 10 lbs., Pbgh.	1.70c
Light rails, 8 lb. Chgo.	1.58c
Light rails, 12 to 14 lbs., Pbgh.	1.65c
Light rails, 12 lbs., Chgo.	1.53c

Freight Rates, Pig Iron

Mahoning and Shenango valleys to:—

Cleveland	$0.95
Newark, N. J.	2.98
Boston	3.18
Philadelphia	2.78
Pittsburgh	.95
St. Louis	3.18

Buffalo to:—

Albany, N. Y.	$1.26
New England (all rail)	2.58
New York and Brooklyn (all rail)	2.58
New York and Brookyln (by canal)	1.25 to 1.60

Virginia furnaces to:—

Boston docks (r. and w.)	$3.05
New England (all rail)	3.25
New York dock (r. and w.)	2.88

Birmingham, Ala., to:—

Cincinnati	$2.90
Chicago	4.00
Cleveland	4.00
Louisville, Ky	2.65
New York (all rail)	6.15
New York (rail and water)	4.25
Philadelphia (all rail)	5.20
Philadelphia (rail and water)	4.00
Pittsburgh	4.90
Savannah, Ga.	2.75

Chicago to:—

Des Moines	$2.80
Milwaukee	.50
Moline, Ill	1.40
Omaha	3.58
St. Louis	1.58

Ironton and Jackson, O., to:—

Chicago	$2.54
Cincinnati	1.26
Cleveland	1.62
Detroit	1.81
Indianapolis	1.58

Light rails 16 to 20 lbs., Pbgh.	1.60c
Light rails 16 to 20 lbs., Chgo.	1.48c
Light rails 25 to 45 lbs., Pbgh.	1.55c
Light rails 25 to 45 lbs., Chgo.	1.43c
Relaying rails, standard, Pbgh. & Chgo.	$23.00 to 24.00
Relaying rails, light, Chgo.	21.50 to 22.50
Angle bars, st. sect., Pbgh. base.	1.50c to 1.75c
Angle bars, st. sections, Chicago	1.50c to 1.75c
Spikes, railroad, Pbgh.	2.10c
Spikes, railroad, Chgo.	2.10c
Track bolts, Pbgh.	2.50c
Track bolts, Chgo.	2.50c to 2.60c
Tie plates, Chgo.	36.00

SHAPES, PLATES AND BARS

Structural shapes, Pbgh.	1.70c to 2.00c
Structural shapes, Chgo.	1.99c to 2.19c
Structural shapes, Philadelphia.	1.909c to 2.159c
Structural shapes, New York.	1.919c to 2.169c
Struc. shapes, San Francisco.	2.00c to 2.05c
Tank plates, Chgo.	1.99c to 2.19c
Tank plates, Pittsburgh.	1.70c to 2.00c
Tank plates, Philadelphia.	1.959c to 2.159c
Tank plates, New York.	1.969c to 2.169c
Bars, soft steel, Pittsburgh.	1.70c to 2.00c
Bars, soft steel, Chgo.	1.99c to 2.19c
Bars, soft steel, Philadelphia.	1.859c
Bars, soft steel, New York.	1.869c
Hoops, carloads, Pittsburgh.	1.90c
Bands, Pittsburgh	1.70c
Shafting, Pbgh., contr. carloads	51 off
Bar iron, Chgo.	1.75c
Bar iron, Philadelphia.	1.959c
Bar iron, New York.	1.969c
Bar iron, Cleveland.	1.80c
Bar iron, Pittsburgh.	1.90c
Hard steel bars, Chicago.	1.80c
Smooth fin., mchy. steel, Chi.	1.68c

SHEETS AND TIN PLATE

No. 28, black, Pittsburgh.	2.50c to 2.75c
No. 28, black, Chgo.	2.69c to 2.94c
No. 28, tin mill, black, Pbgh.	2.45c
No. 28, galvanized, Pbgh.	4.75c to 5.25c
No. 28, galvanized, Chgo.	5.19c
No. 10, blue anl., Pbgh.	2.25c
No. 10, blue annealed, Phila.	2.359c
Tin plate, 100 lb., coke base.	$3.60

EXTRAS FOR SHEET OR TIN MILL SPECIFICATIONS

(Per hundred pounds.)

Single pickled, cold roll. and re-anl.	30 cents
Hot roll'd pick'd and anl., tin mill.	25 cents
Full pickl'd, cold rolled and re-anl.	50 cents
Auto sheets	75 cents
Blued stove pipe stock	10 cents
Range steel	30 cents
Re-squaring	10 cents
Roller leveling	10 cents
Patent leveling and re-squaring	35 cents
Oiling sheets	10 cents
Deoxiding	10 cents
Lime finish	10 cents
Open-hearth stamping steel, free fr. mill scale	55 cents
Special open hearth deep stpg. steel free from mill scale	80 cents
Extra deep special auto body stock.	$1.25
Ext. for 28 gage ov. 32 to 36-in. wide	10 cents
No reduction for sheets not annealed.	

The above extras apply on both sheet and tin mill specifications, at the same rate.

IRON AND STEEL PIPE

(Pittsburgh.)

	Black. Butt-weld.	Galv. Butt-weld.
Steel, ¾ to 3 inches	78	63½
Iron, ¾ to 2½ inches	70	52
	Lap-weld.	
Steel, 2½ to 6 inches	77	62½

BOILER TUBES.

Steel, 3½ to 4½ inches l. c. l.	68
Iron, 3½ to 4½ inches l. c. l.	56

WIRE PRODUCTS

(Retailers' price 5 cents above jobbers' quotation.)

Wire nail jobbers, Pittsburgh.	$2.00
Plain wire, jobbers, Pittsburgh.	1.85
Galvanized wire, jobbers, Pbgh.	2.55
Polished staples, Pbgh.	2.15
Galvanized staples, Pbgh.	2.85
Barb wire, painted, jobbers, Pbgh.	2.15
Barb wire, galv., jobbers, Pbgh.	2.85

IRON AND STEEL PRICES

Corrected up to Tuesday noon

BOLTS AND NUTS

(Delivered within 20-cent freight radius.)

Carriage bolts, ⅜ x 6 inches, smaller or shorter, rolled threads, 70 and 12½; cut threads 70 and 5; larger or longer, 65.

Machine bolts with hot pressed nuts, ⅜ x 4 inches, smaller or shorter, rolled 70, 10 and 7½; cut, 70 and 12½; larger or longer, 65 and 10.

Gimlet and cone point lag bolts, 75 and 15.

Hot pressed square, blank or tapped nuts, $4.50 off list; hot pressed hexagon blank or tapped, $4.70.

Cold pressed square, blank or tapped, $4.50 off; hexagon, blank or tapped, all sizes, $5.70.

RIVETS

Structural rivets, Pbgh	2.50c
Structural rivets, Chgo. delivery	2.55c
Boiler rivets, Pbgh	2.60c
Boiler rivets, Chgo. delivery	2.65c

STEEL SHEET PILING

(Pittsburgh.)

Base sizes	1.75c

STANDARD STEEL CHAIN.

Chain, ⅜ inch proof coil	3.65c to 3.75c

COLD ROLLED STRIP STEEL

(Subject to regular extras.)

0.10 to 0.19 Carbon. 1½ inch and wider.	Base price Cut to length Hard.	Soft.
0.100 and thicker	3.60	3.85
0.050 to 0.099 inc	3.70	3.95
0.035 to 0.049 inc	3.85	4.10
0.031 to 0.034 inc	4.20	4.50
0.025 to 0.030 inc	4.35	4.75
0.020 to 0.024 inc	4.55	4.95
0.017 to 0.019 inc	5.45	5.95
0.015 and 0.016	5.85	6.35
0.013 and 0.014	6.70	7.20
0.012	7.30	7.80
0.011	7.65	8.15
0.010	8.00	8.50
	Coils.	
0.100 and thicker	3.50	3.75
0.050 to 0.099 inc	3.55	3.80
0.035 to 0.049 inc	3.70	3.95
0.031 to 0.034 inc	3.85	4.25
0.025 to 0.030 inc	3.95	4.35
0.020 to 0.024 inc	4.05	4.45
0.017 to 0.019 inc	4.25	4.85
0.015 and 0.016	4.75	5.25
0.013 and 0.014	5.45	5.95
0.012	5.80	6.30
0.011	6.15	6.65
0.010	6.50	7.00

CAST IRON WATER PIPE

Four-inch, Chicago	29.50 to 30.00
Six-inch and larger, Chicago	27.50 to 28.00
Six-inch Class B, New York	26.50 to 27.00
Four-inch, Class B, New York	29.00 to 30.00
Four-inch, Birmingham	25.00
Six-inch and larger, Birmingham	23.00

Light weight water and gas pipe, $1 per ton higher than standard water.

WAREHOUSE PRICES

Steel bars, Chicago	2.20c
Steel squares, 2-in. & ov., Cleve.	2.65c
Steel rounds, 2 in. and over	3.00c
Steel bars, under 2-in., Cleveland	2.50c
Steel bars, Cincinnati	2.40c
Steel bars, Philadelphia	2.30c to 2.40c
Steel bars, New York	2.40c to 2.45c
Steel bars, St. Louis	2.25c
Steel bars, St. Paul	2.30c
Steel bars, over 2-inch, Buffalo	2.35c
Steel bars, Buffalo	2.20c
Iron bars, Chicago	2.30c
Iron bars, Cleveland	2.45c
Iron bars, St. Louis	2.20c
Iron bars, Cincinnati	2.25c
Iron bars, Philadelphia	2.20c to 2.30c
Iron bars, New York	2.30c to 2.35c
Hoops, Chicago	2.15c
Shapes and plates, Chicago	2.30c
Shapes and plates, Cleveland	2.50c
Shapes and plates, Buffalo	2.35c
Shapes and plates, Cincinnati	2.35c
Shapes and plates, St. Louis	2.35c
Shapes and plates, Philadelphia	2.30c to 2.40c
Shapes, New York	2.40c
Plates, New York	2.50c
Shapes and plates, St. Paul	2.40c
No. 10 blue anl. sheets, Chgo	2.60c
No. 10 blue anl. sheets, Clevel'd	2.65c
No. 10 blue anl'd sheets, Buffalo	2.65c
No. 10 blue anl. sh. St. Louis	2.65c
No. 10 blue anl. sheets, Cinci	2.65c
No. 10 blue anl. sheets, St. Paul	2.70c
No. 28 black sheets, Chgo	2.90c
No. 28 black sheets, Cleveland	2.95c
No. 28 black sheets, Cincinnati	3.00c
No. 28 black sheets, St. Louis	2.95c
No. 28 black sheets, St. Paul	3.00c
No. 28 galv. sheets, Chgo	4.80c to 5.00c
No. 28 galv. sheets, Cleveland	5.25c
No. 28 galv. sheets, Cincinnati	5.25c
No. 28 galvanized sheets, St. L.	5.10c

Freight Rates, Coke

Connellsville regions, per 2,000 lbs., to:—	
Baltimore	$1.80
Buffalo	1.85
Chicago	2.50
Cleveland	1.60
Detroit	2.10
East St. Louis	2.80
Joliet	2.50
Louisville	2.50
Milwaukee	2.85
New York	2.85
Philadelphia	2.05
Pittsburgh	.75
Richmond, Va.	2.94
Toledo	1.85
Valley Furnaces	1.20
Cincinnati	2.00

IRON AND STEEL SCRAP

(Net Tons.)

No. 1 railroad wrought, Chgo	$15.50 to 16.00
No. 1 railroad wrought, Cleve	14.50 to 15.00
No. 1 railroad wrought, St. L.	15.00 to 15.50
No. 1 railroad wrought, Cinci	12.25 to 12.75
No. 2 railroad wrought, Chgo	14.50 to 15.00
No. 2 railroad wrought, St. L.	14.75 to 15.00
Arch bars and transoms, Chgo	17.50 to 17.75
Arch bars and transoms, St. L.	16.50 to 17.00
Knuckles, coup., Chgo	14.50 to 15.00
Springs, Chgo.	15.75 to 16.00
Knuckles, coup. & spr'gs, St. L.	14.50 to 15.00
Shafting, Chgo.	16.75 to 17.25
Shafting, St. Louis	16.00 to 16.50
Steel car axles, Chicago	21.75 to 22.25
Steel car axles, St. Louis	22.00 to 23.00
Locomotive tires, Chicago	15.50 to 16.00
Locomotive tires, St. Louis	15.00 to 15.50
Cut forge, Chicago	14.75 to 15.00
Pipes and flues, Chicago	12.00 to 12.25
Pipes and flues, Clevel'd (nom.)	11.25 to 11.75

Freight Rates, Finished Material

From Pittsburgh, carloads, per 100 lbs. to:—

New York	16.9 cents
Philadelphia	15.9 cents
Boston	18.9 cents
Buffalo	11.6 cents
Baltimore	15.4 cents
Cleveland	10.5 cents
Cincinnati	15.8 cents
Chicago	18.9 cents
Minneapolis and St. Paul	32.9 cents
Denver	68.6 cents
St. Louis	23.6 cents
New Orleans	30 cents
Birmingham	45 cents
Pacific coast, (all rail)	73.9 cents
Pacific coast, (tin plate)	70 cents
Pacific coast, via Panama canal	61.9 cents

Pipes and flues, St. Louis	10.50 to 11.00
No. 1 cast, Chicago	13.00 to 13.50
No. 1 cast, Cleveland	12.50 to 13.00
No. 1 cast, Cincinnati	11.50 to 12.00
No. 1 cast, St. Louis	9.50 to 10.00
No. 1 busheling, Chicago	13.25 to 13.50
No. 1 busheling, Cleveland	13.75 to 14.25
No. 1 busheling, Cincinnati	10.00 to 10.50
No. 1 busheling, St. Louis	11.50 to 12.00
No. 2 busheling, Chicago	9.25 to 9.75
No. 1 boiler plate, cut, Chgo	10.50 to 11.00
No. 1 boiler plate, cut, St. L.	7.00 to 7.50
Boiler punchings, Chicago	13.00 to 13.50
Cast borings, Chicago	8.00 to 8.25
Cast borings, Cleveland	7.25 to 7.50
Cast borings, Cincinnati	7.50 to 8.00
Cast borings, St. Louis	7.50 to 8.00
Machine shop turnings, Chgo	8.00 to 8.50
Machine shop turnings, Cleveland	6.75 to 7.00
Machine shop turnings, Cinci	$ 7.00 to 7.50
Machine shop turnings, St. L.	8.00 to 8.50
Malleable agricultural, Chgo	11.50 to 11.75
Malleable agriculture, St. Louis	11.00 to 11.50
Malleable railroad, Chicago	14.00 to 14.25
Malleable, Cincinnati	8.00 to 8.50
Malleable railroad, St. Louis	12.50 to 13.00
Angle bars, iron, Chicago	17.25 to 17.50
Angle bars, iron, St. Louis	15.50 to 16.00
Angle bars, steel, Chicago	14.00 to 14.50
Angle bars, steel, St. Louis	14.00 to 14.50
Stove plate, Chicago	10.50 to 10.75
Stove plate, Cleveland	9.75 to 10.00
Stove plate, Buffalo	9.50 to 10.00
Stove plate, Cincinnati	8.00 to 8.50
Stove plate, St. Louis	10.00 to 10.50
Bundled sheet, Cincinnati	8.50 to 9.00

(Gross tons.)

Heavy melting steel, Pbgh	$17.50 to 18.50
Heavy melting steel, Buffalo	15.50 to 16.00
Heavy melting steel, Chicago	15.50 to 16.00
Heavy melting steel, Cleveland	15.25 to 15.75
Heavy melting steel, Cincinnati	14.00 to 14.50
Heavy melting steel, eastern Pa.	16.00 to 16.50
Heavy melting steel, New York	13.00 to 13.50
Heavy melting steel, St. Louis	16.00 to 16.50
Grate bars, Buffalo	10.50 to 11.00
Grate bars, N. J. points	11.00 to 11.25
No. 1 railroad wrought, east. Pa.	20.00 to 21.00
No. 1 railroad wrought, Pbgh	16.75 to 17.00
No. 1 R. R. wrght., New York	18.00 to 19.00
No. 1 R. R. wrought, Buffalo	14.50 to 15.00
Shafting, New York	16.50 to 17.00
Shafting, eastern Pa.	19.50 to 20.00
Wrought pipe, New York	12.25 to 12.75
Wrought pipe, Buffalo	12.50 to 13.00
Wrought pipe, eastern Pa	14.25 to 14.75
Mch. shop turnings, New York	8.75 to 9.25
Machine shop turnings, Buffalo	7.00 to 7.50
Mch. shop turnings, Pbgh	9.50 to 9.75
Mch. shop turnings, eastern Pa.	10.75 to 11.25
Heavy axle turnings, Buffalo	11.50 to 12.00
Cast borings, New York	8.75 to 9.25
Cast borings, eastern Pa	10.75 to 11.25
Cast borings, Buffalo	8.50 to 9.00
Cast borings, Pittsburgh	10.25 to 10.50
Stove plate, N. J. points	11.25 to 11.50
Stove plate, Pittsburgh	10.00 to 10.50
Stove plate, eastern Pa	11.50 to 12.00
Shoveling steel, Chicago	15.25 to 15.50
Shoveling steel, St. Louis	14.50 to 15.00
Reroll. rails, 5 ft. & ov., Pbgh.	18.25
Reroll. rails, 5 ft. & ov., Chgo.	15.50 to 16.00
Reroll. rails, 5 ft. & ov., Cleve.	15.50 to 16.00
Reroll. rails, 5 ft. & ov., E. Pa.	18.00 to 19.00
Reroll. rails, 5 ft. & ov., St. L.	17.00 to 18.00
Steel rails, short, Chicago	15.75 to 16.25
Steel rails, short, Cleveland	18.00 to 18.25
Steel rails, short, St. Louis	16.00 to 16.50
Iron rails, Cleveland (nom.)	17.00 to 18.00
Iron rails, Chgo.	17.50 to 18.00
Iron rails, Buffalo	16.00 to 16.50
Iron rails, Cincinnati	14.00 to 14.20
Iron rails, St. Louis	16.00 to 16.50
Frogs, switches, guards, Chgo	15.50 to 16.00
Frogs, switches, guards, St. L.	16.00 to 16.50
Car wheels (iron), Pittsburgh	13.75 to 14.00
Car wheels (steel), Pittsburgh	18.75 to 19.00
Car wheels, Chicago	14.75 to 15.25
Car wheels, eastern Pa.	15.25 to 15.75
Car wheels, Buffalo	14.50 to 15.00
Car wheels, N. Y.	12.50 to 13.00
Car wheels, St. Louis	14.50 to 15.00
Iron axles, Pittsburgh	22.00 to 22.50
Iron axles, Cincinnati	20.50 to 21.00
Iron axles, eastern Pa.	23.00 to 24.00
Iron axles, Chicago	22.75 to 23.25
Iron axles, Buffalo	21.00 to 21.50
Iron axles, St. Louis	15.00 to 15.50
Steel car axles, New York	19.00 to 20.00
Steel car axles, Buffalo	21.00 to 21.50
Steel car axles, Cleveland	22.00 to 23.00
Steel car axles, eastern Pa.	22.00 to 23.00
No. 1 busheling, Buffalo	13.00 to 13.50
No. 1 busheling, Pbgh	13.75 to 14.00
No. 2 busheling, Buffalo	10.50 to 11.00
Low phos. steel, Buffalo	19.50 to 20.00
Low phosphorus steel, Pbgh	21.00 to 22.00
Low phos. steel, eastern Pa.	20.50 to 21.00
No. 1 forge, eastern Pa.	12.50 to 13.00
No. 1 cast, eastern Pa.	16.00 to 16.50
No. 1 cast, Pittsburgh	14.50 to 15.00
No. 1 heavy cast, N. J. points	13.50 to 14.00
Mall. railroad, Cleveland	16.25 to 16.50
Malleable railroad, Pittsburgh	14.75 to 15.00
Malleable railroad, Buffalo	14.50 to 15.00
Malleable railroad, eastern Pa.	14.00 to 14.50
Bundled sheet, Pittsburgh	14.25
Bundled sheet, Cleveland	12.50 to 12.75
Bundled sheet, Buffalo	11.00 to 11.50
No. 1 R. R. and mch. cast, Bfl.	14.25 to 14.75
Boiler plate sheared, Buffalo	13.00 to 13.50

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The Control of Chill in Cast Iron

(*Continued from Page* 1173.)

fact, a close analysis of Mr. Johnson's data brings out more forcibly my contention, namely, that the quantitative control of chill in commercial cast irons, aside from the physical effects of casting temperature, size of test, and size of chiller, is practically dependent upon the percentages of silicon and total carbon present. In support of this statement, a chart, Fig. 8, is offered, in which Mr. Johnson's data are tabulated. His *A* and *B* series, not having a measurable chill, have been left out. It will be noticed that his *G*, *C* and *F* series, forming a line for ⅛-inch chill, and his *E* on a line representing ¼-inch chill, are in perfect agreement with my data, shown in the lower right-hand corner and all lines verge toward the point representing .667 carbon and no silicon. While his specimen *D* does not seem to agree with this theory, it is entirely possible that it may not be in its proper position, either because of error in analysis, making silicon or carbon too low, or because the sample was not representative; though a larger test pig than usual, or very low pouring temperature, would cause the specimen to show no chill.

How Your Leather Belting is Made

(*Continued from Page* 1177.)

down on the pulleys, the edges raising. The belt was narrowed 2 inches to 16 inches and did the work perfectly. An opposite case was that of a 6-inch light double belt on a high speed drive, long centers, power off and on frequently. The belt jumped so badly it could not be used. A heavy double was substituted and the trouble ceased at once.

The weave room in a cotton mill was belted medium weight first quality belts and the plant was not a paying proposition. A study of conditions convinced belt engineer that they were using too light a belt and the belts were replaced with heavier first quality belts, and the plant was able to pay dividends.

A salesman recommended a light double belt for a mill drive, the master mechanic of the mill insisting on a heavy single. There were several similar drives, so one of each was installed. The record showed that the double was taken up and shortened 2 inches five days after installation and not touched again when this record was completed, while the single was shortened 2 inches the day installed, 2½ inches two days later, 4 inches three days after this, 3 inches more 16 days later, 3 inches more 46 days later, and 5 inches again after 29 days more, when it was practically worn out.

Rotary Roaster Kilns for Iron Ores

(*Continued from page* 1179)

five. On a small kiln, 60 x 5 feet, the labor cost per ton, on high-sulphur fine cinder, averaged 40 cents for several months, and with the same kiln, using high-grade lump cinder, this figure was reduced to 30 cents, but both these figures were excessive on account of faulty design, which made necessary three and four men on a shift; also on account of a very low output per man, owing to the small size of the kiln. On the other hand, this was partly balanced by the fact that wages were low, and only two shifts were necessary. Repairs and supplies should not cost over 8 cents per ton of roasted ore on a kiln of any size. The important factor in economic kiln operation is careful designing, and it cannot be said too strongly that the cost of operation of a rotary kiln will be almost entirely determined by the layout of the plant.

The roasted ore, for which the cement term of clinker is used, works very well in the furnace. In Virginia practice,

where the blast pressure is comparatively low, it is not essential that the nodules should be large. If 80 per cent of the clinker stays on a screen of ⅛-inch mesh, there will be no difficulty in the furnace at pressures of under 9 or 10 pounds. It is very easy to make larger nodules, but as a higher temperature is required to do so, with attendant evils of more frequent ringing, greater fuel expense, and a harder, less porous product, it is better to keep the nodules as small as possible. The clinker frequently forms from one-sixteenth to one-half of the burden without ill effects, working with brown ore and specular hematites, and by its use the yield of the southern furnaces, where the native ores are lean, can be raised from a scant 42 per cent to 50 per cent and more, depending on the quality of the cinder.

It is in localities where the native ore is lean that the kiln is valuable. It affords an opportunity of enriching the burden with a high-grade ore at a much lower cost than could be done by direct purchase of lake or other rich ores, and where the silica in the native ore averages well over 20 per cent, it is indispensable that the burden should be "sweetened" in some way to cut down the excessive amount of flux and consequent fuel necessary to produce good iron.

Production of Graphite in 1914

The form of carbon known as graphite or plumbago occurs in nature in a variety of ways and serves a great many useful purposes, chief among which are its uses in the manufacture of crucibles and other refractory products, as lubricants, for foundry facings, as stove polishes, etc. Imports of graphite from Mexico nearly equaled those for 1913 in spite of the turbulent conditions in that republic. The imports of Korean graphite were about half again as large in 1914 as in 1913, increasing from 4,170 to 6,327 tons. The importation from Ceylon, on the other hand, was about half that for 1913.

The two uses of graphite that seem to have shown the greatest gains during the year are its application to automobile lubrication and its use as a preparation to loosen boiler scale. The effect of the graphite in the boilers is mechanical, not chemical. Being chemically inert it cannot injure the iron of the boilers or affect the quality of the boiler water. It does not prevent the formation of scale, but the fine graphite particles by mixing with the scale during its formation render it soft and crumbly and prevent it from adhering strongly to the boiler. It can then be easily removed. It is said, moreover, that graphite is efficient in loosening old scale, the graphite particles working into the pores of the scale and between the scale and the boiler.

In October, 1913, patents were applied for in Austria and Germany covering the use of graphite as a coloring material and filler in the manufacture of gray to black paper, pasteboard and textiles. The process, which is especially designed for paper and pasteboard manufacture, consists in incorporating in the goods powdered graphite, which may be added dry or as a fine slime. The graphite is said to be superior to gray mineral or chemical coloring matter hitherto used, in that the color does not fade in prolonged exposure to sunlight. Streaked and spotted defects, it is claimed, are less likely to appear during the process of making the paper. The opening of a new "flake" graphite property, three miles north of Ashland, Ala., is noteworthy.

Graphite produced in the United States in 1914 was approximately 73 per cent, by value, of that imported for consumption. Of the domestic production about one-third, by value, was natural graphite, and two-thirds manufactured graphite.

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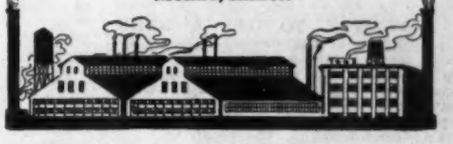

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